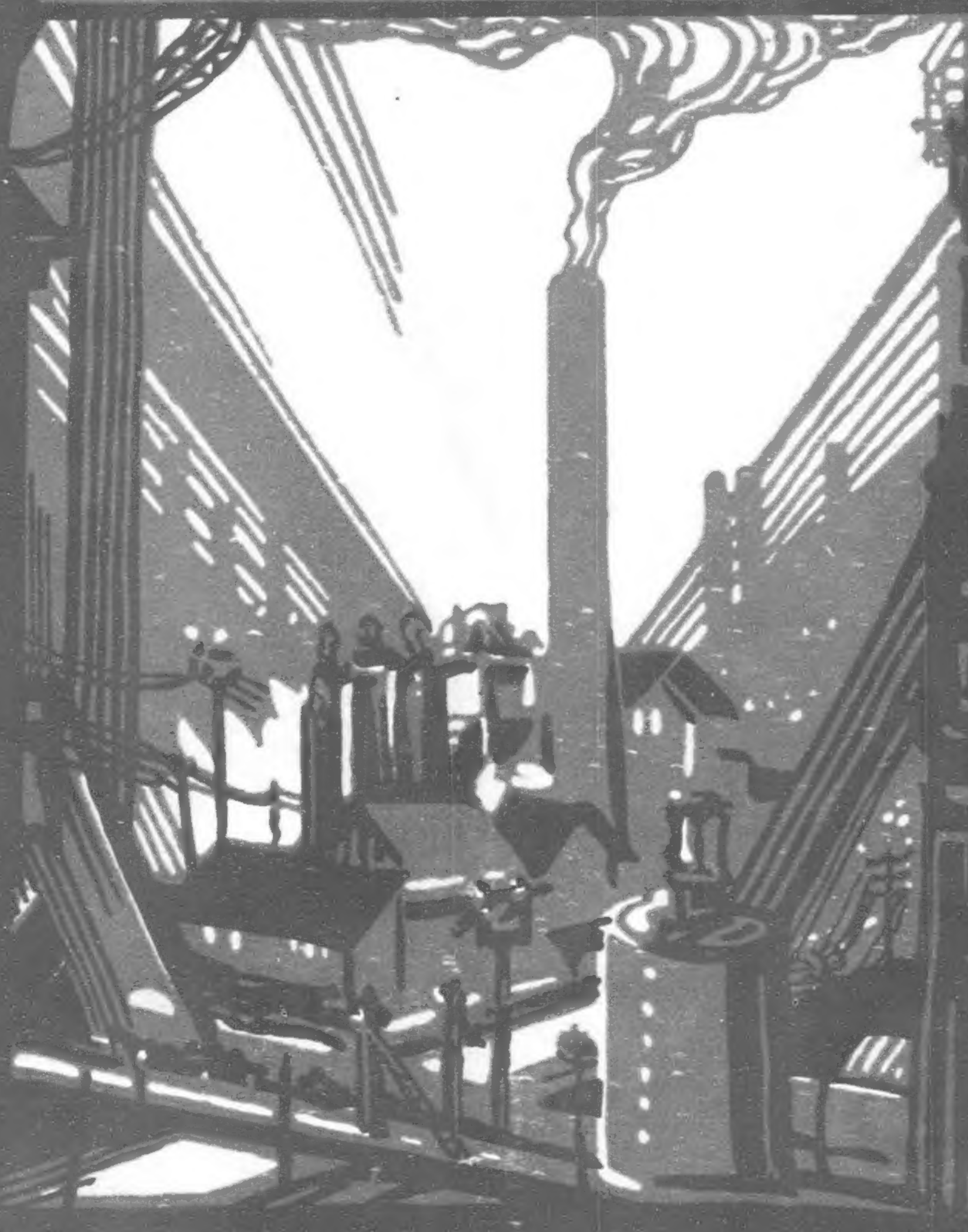


FINANCE

COMMERCE

ENGINEERING

THE
FAR EASTERN
REVIEW



上海黃浦灘
第四號

遠東
時報

PRESENT CONDITIONS IN RUSSIA
—
WE LOVE A CRUSADE
—
CENTRAL CHINA RECONSTRUCTION

Vol. XXXIV

MARCH, 1938

No. 3

N. Y. K. LINE

Founded in 1885

150 Vessels

598,000 Gross Tons

Wherever you go over the ocean, comfort and excellent courteous service are always assured by the N. Y. K.'s fast and modern liners cleaving the seven seas.

N. Y. K. Principal Passenger Services

Orient-California Service	-	-	-	Fortnightly
Orient-Seattle-Vancouver Service	-	-	-	Fortnightly
Japan-Europe Service	-	-	-	Fortnightly
Japan-Australia Service	-	-	-	Monthly
Japan-South America (West Coast) Service	-	-	-	Monthly
Japan-Bombay Service	-	-	-	Monthly
Shanghai-Nagasaki-Kobe Rapid Express Service				Every 4 days
etc.				

Various Round Trip Fares quoted on very economical and convenient basis

N. Y. K. LINE

(Japan Mail)

Head Office: TOKYO, JAPAN

Shanghai Office: 31, THE BUND

Offices and Agencies throughout the World

General Passenger Agents, Cunard White Star Line in the Orient

The Far Eastern Review

ENGINEERING

FINANCE

COMMERCE

VOL. XXXIV

SHANGHAI, MARCH, 1938

No. 3

Present Conditions in Russia

By HAROLD DENNY, in *The New York Times*, September 13-19, 1937

PARIS, Sept. 12.—Dramatic and bewildering is the twelvemonth in the history of the Soviet Union that has just drawn to a close. It has been a year of considerable positive accomplishment, despite recessions in many key industries and disorganization of much of the Soviet economic and political machinery. But most of all it has been a bloody year, the bloodiest since the early years of the Bolshevik revolution.

It has been a year of startling contrasts. Early on the morning of August 24, 1936, sixteen men, including the world-famous old Bolshevik leaders Gregory Zinoviev and Leo Kamenev, were convicted of plotting to assassinate the present Soviet leaders, from Joseph Stalin down, to seize power, and betray the country to capitalism. They were led stumbling out forthwith to be shot.

On December 5, 1936, the last Congress of Soviets tumultuously adopted Stalin's new Constitution, advertised by Soviet spokesmen as the most liberal and most democratic in the history of mankind.

Then, in March of this year, Stalin in a speech before the central committee of the Communist party demanded genuine democracy within the party, and at the same time in a little noted part of his speech he called for cleansing the country of all disloyal elements, which, though not realized then, was the signal for the wave of executions, imprisonments, dismissals, and degradations that are continuing unabated to this day. The twelvemonth just concluded also brings the Soviet regime close to its twentieth birthday, for on November 7 the country will elaborately celebrate the seizure of power by a little group of determined men, high among whose councils were leaders who now are dead at the hands of their one-time comrades or in jail awaiting whatever inglorious fate.

Thus now is an appropriate time to review the situation and weigh the possible reasons for this drastic and continuing purge. These possible reasons are beginning to emerge from obscurity. They are still regrettably vague and incapable of concrete proof in a land where the simplest affair is often veiled in semi-Oriental mystery, where in treason cases all but the "show trials" are held behind closed doors and their evidence not revealed, and where foreigners are now objects of suspicion, cut off to a large degree from personal contacts and compelled to live their lives in Moscow beyond an invisible pale.

Yet we have the Soviet press, which in recent months has been filled with amazingly frank information; we have eyes to see with and ears to hear with, and so, though much information is denied us, much filters through, and we do get the feel of things.

The dead of this past twelve months—those names actually announced in the limited number of provincial newspapers reaching our Moscow desks—number many hundreds and the toll is increasing almost daily. The hunt for "spies, wreckers, and diversionists" is now dredging into the humbler strata of the population.

Whereas a year ago the Soviet authorities were shooting the bearers of names famous in bolshevism and less than three months ago the greatest generals the Red Army had developed were executed, now the Government has got down to shooting cooks as terrorists because they put rotten meat in officials' stew, and women attendants in a nursery for poisoning children's foods for counter-revolutionary purposes.

In between the one-time leaders of a world revolution and the restaurant help lie those hundreds of big and little men shot for varying crimes, ranging from wrecking trains at the behest of foreign

spies to abusing the peasantry and disrupting agriculture in order to discredit the Soviet regime and lay the basis for a return to capitalism.

Untold thousands more have been arrested in every part of the Soviet Union, one deduces from reading between the lines of the Soviet press, for arrests are rarely announced in so many words. Innumerable others have been dismissed from their jobs under circumstances that will militate against their getting desirable jobs again. And those expelled from the Communist party in recent months are legion.

The Soviet purge is affecting almost every conceivable field of life. Those that have already felt it include:

(1) Old Bolsheviks, men who helped to make the revolution but fell out with Stalin on doctrinal issues or came to be regarded as politically untrustworthy, so that they were either accused of counter-revolution or shelved.

(2) The Red Army, eight of whose greatest generals, headed by Marshal Mikhail N. Tukhachevsky, were executed last June on the amazing charges of selling military secrets to Germany.

(3) The People's Commissariat of Internal Affairs (NKVD), which has taken the place and functions of the old OGPU. Its higher ranks, from Henry G. Yagoda, the commissar, down, have been combed, and since the downfall of the sinister figure of Yagoda last fall hundreds of its higher officials are reliably reported to have followed him to prison—a feature of the purge that apparently is popular with Moscow's general public.

(4) The Commissariat of Foreign Affairs, a number of whose highest officials, including Nikolai Krestinsky and Leo M. Karakhan, assistant commissars, and three members of the Press Bureau, which includes the censorship, disappeared under circumstances suggesting their arrest.

(5) The governing organs and Communist party leadership of constituent republics, notably White Russia, Georgia, and the Ukraine, where there have been mass arrests and dismissals, together with suicides and executions.

(6) The Communist party, from members close to the seats of power in Moscow to local officials in remote provinces.

(7) The Young Communist League—charged with the vitally important task of educating Soviet youth in loyalty to the Stalin regime—many of whose leaders have been removed, some under the ominous accusation of being "enemies of the people."

(8) Osoaviakhim, organization containing millions of members devoted to training army reserves, whose former chief, General Robert P. Eideman, was one of the generals executed with Marshal Tukhachevsky.

(9) Local agricultural administrations, from regional officials to chairmen of collective farms and agronomists, a number of whom have been shot recently for alleged anti-State activities.

(10) Industries of all sorts, resulting in a general shifting of commissariats as well as numerous dismissals.

(11) Railway transport, which alone has provided hundreds of firing squads with victims, especially in the Far East.

(12) The State Planning Commission, which is the brain of this vast State-controlled economic organism.

(13) Foreigners. There has been a general, though by no means complete, "liquidation" of foreigners in Russia. It started with citizens and former citizens of potentially hostile countries,

such as Germany, Japan, and Poland, and has spread to citizens of other countries with which the Soviet Union has no quarrel.

Most foreigners who had retained their foreign citizenship were simply asked to leave the country. Many foreign radicals, however, who had entered Russia and taken Soviet citizenship were arrested. The most notable of these was Bela Kun, one-time leader of the short-lived Soviet regime in Hungary. More than a hundred Hungarians he induced to take refuge in Russia are reliably reported to be under arrest.

Even the Communist International staff is reported to have been heavily raided and many of its German members put in jail. And now a young Englishman has been arrested in Leningrad on charges of espionage.

There has been a general clearing out of American and other foreign engineers. Some American engineers of high ability are still employed, however, in airplane manufacturing, radio installation, and ice cream-making, in which the Soviet Union still desires foreign technical aid. These report they are receiving every courtesy.

Even this long list is incomplete. Inroads have been made into the fields of education, journalism, literature, and drama, though apparently not on a mass scale. The editor of the *Komsomolskaya* (Young Communist) *Pravda* was among those denounced as "enemies." Another Soviet writer who has disappeared is accused of spreading Nazi propaganda, because in articles and books on Germany, on which he was an authority, he quoted from Adolf Hitler too fully.

The political director of the famous Moscow Art Theater was brusquely removed, as were the director of the Mali Theater and Natalie Sachs, internationally known director of the Children's Theater. Even the Park of Culture and Rest has not been spared, a woman director and lesser executives having been removed, if not arrested.

So extensive a purge in so many fields would seem to indicate a general breakdown. But the significant thing is that it has not occurred and there is no reason now to believe it will occur. True, many industries are seriously lagging, but, ridden as they are with fantastic inefficiency, most of them are functioning fairly well by previous standards in the Soviet Union, and there is no reason to believe the country will not struggle through.

In any judgment of Russia one must bear in mind that the country itself is enormously large and enormously rich, with every essential raw material and adequate food supplies. It must be remembered also that the Russian people have enormous powers of resistance. They can "take it," else they would never have survived the frightful years through which they have passed.

One would think, too, that the waves of arrests, in which so many are losing relatives or friends, would stir up dangerous resentment. Worry is apparent in Moscow, but, strangely enough, the tension when I left Moscow a few days ago seemed less than it was immediately following the Tukhachevsky execution.

The people have become used to it. Their sensibilities have been dulled, and, I think, there is a certain fatalism in their attitude. Arrests are commonplace in Russia. The Russians have always been subject to political persecution, and being arrested is certainly no disgrace. The Russians appear to accept it with amazing equanimity.

Recently a simple artisan was arrested as he went with a card of introduction from one foreigner to another to do a job of manual work. He was turned over to the Secret Police, who, believing him an important spy, threw him in a cell with some intellectuals, similarly suspected. After two days and nights he was turned loose.

An American would have been hopping mad at such treatment, but not this Russky (Russian). He was very cheery at the fact that he had got out at all and flattered at being enabled to associate with cultured company for the first time in his life.

* * *

PARIS, Sept. 13.—Now what is the explanation for the Soviets' unceasing purge of allegedly disloyal elements and its dragnet hunt for spies? The precise reasons are hidden behind the inscrutable Kremlin walls and the grim gray-green Lubyanka prison—headquarters of the political police, with its execution chambers beneath—and they may never be known.

But foreign diplomats in Moscow are piecing together scraps of evidence, studying indications and probabilities and making shrewd guesses. Some of these diplomatic interpretations are founded on reasons shaped by three diverse factors.

First, there is the international situation, in which the Soviet Union conceives itself and the world to be threatened by aggressive Powers, notably the Fascist States of Germany, Italy, and Japan.

Second, there is the internal economic situation, disturbed by the lagging of many industries, that is caused by bureaucratic inefficiency and abdication of executives who fear to take responsibility, by a breakdown of labor discipline and by some sabotage, though few foreigners in Moscow believe there is anywhere as much deliberate wrecking as the Soviet press, shrieking at delinquents, alleges.

Third, there is the internal political problem presented by the fact (if one credits the Soviet press's daily denunciation of enemies within the gates) that there is a great deal of opposition to the Stalin regime—more, it would seem, than Joseph Stalin supposed last winter when he gave the country a new Constitution, with provision for the secret ballot.

As to the Soviet Union's fear of spies, it is undoubtedly justified. Germany has repeatedly declared her hunger for the Soviet Ukraine and Chancellor Adolf Hitler has never withdrawn the statement in his book *Mein Kampf* that the place for German expansion is to the east. Poland could do with a slice of Soviet territory herself if she could get it easily and safely, and, though the Soviet's relations with Finland are now harmonious, there is an articulate group in Finland that talks of "a greater Finland," which would include Soviet Karelia and perhaps stretch even to the Urals. And in the Far East the Soviet and Japan scowl across the Amur River and occasionally take potshots.

Germany, Japan, and even Poland are notoriously given to spying. There can be no doubt that they have built up elaborate espionage organizations in Russia and are employing considerable numbers of Russians. We ourselves have only to look back to the World War, when Germany planted spies and saboteurs all over America even before we entered the conflict.

In the Far East the Japanese have suitable spy material in White Russian refugees in Manchuria and it is entirely credible that they have smuggled many with forged passports into Siberia, where they can pass easily as Soviet citizens.

But legitimate as is the Soviet Union's fear of spies, it has become a psychosis, as the fear became a psychosis with many Americans during the World War. In the Soviet Union it is intenser and goes to greater extremes. And how account for such appalling numbers of those accused and even executed as spies and traitors in the service of foreign States?

When they shoot them twenty, thirty, seventy-two at a time, as they have been doing in the Far Eastern section of the Transsiberian Railway, up to an astounding total, when leading figures of provincial governments and Communist party organizations are arrested *en bloc* as agents of foreign States, when some of the most honored figures are suddenly branded as traitors, one must assume that if these accusations are true there is an amount of disapproval of the Stalin regime—disapproval even to a willingness to betray one's country—that scarcely harmonizes with the picture of a happy and contented land that the Communists paint for foreign admiration.

Foreigners in Moscow are rather skeptical about the arrests and dismissals of industrial executives and engineers on charges of treasonably inspired sabotage. There undoubtedly is sabotage, but few believe it is on the immense scale implied by the dismissals—often accompanied by the damning epithet, "enemy of the people"—of thousands in every field of industry.

The Soviet dictatorship, like any other dictatorship, must wear a halo of infallibility. It never admits it is wrong to any serious degree, though sometimes it gently chides itself, as in Stalin's rebuke to the Communist party leadership last March for insufficient contact with the masses.

Now industry and agriculture, which is conducted like industry, are of all-consuming importance to the Soviet's well-being and the basis of its military strength. Everything is being done and every sacrifice is exacted of the people to make them go. Agriculture is going relatively well, though grievous abuses—abuses that in some regions have driven thousands of peasants to leave collective farms—are exposed from time to time.

But industry is going badly from top to bottom. At the top, executives and engineers, terrified lest any honest mistake be distorted into "Trotskyist sabotage," dodge responsibility, naturally causing delay and disorganization.

The Kremlin is repeatedly urging Soviet industry to pattern itself after United States industry. The Soviet Union has bought

and built machinery for a formidable industrial set-up. Its labor is capable enough, and after starting under the tutelage of foreign technicians, the Soviet has developed its own executives and engineers who, although in most cases unequal to engineers in more advanced capitalist countries, are certainly able to do better work than they are doing.

The Soviet has given industry everything in materials, but has failed to give the most important thing of all—freedom to executives to use their own initiative and to make their own decisions, confident that if a high percentage of decisions are correct an occasional error will be forgiven. In the Soviet an executive error may land a good man in prison under terrible charges of “wrecking,” especially if in his past he ever made a political misstep from the standpoint of Stalinism.

And the whole economic organism is choked with bureaucracy, whose clutch is unbelievable unless one has actually encountered it.

At the other end of the scale, many workers at machines are demoralized, according to detailed accounts furnished by the organs of various commissariats. Bad housing conditions, inequitable pay scales and the failure of factories to pay on time have created widespread resentment. Many workers in the worst-run plants are so disgusted that they either are quitting or are staying away half the time—as nearly as they can come to a strike in Russia, where an actual strike probably would be construed as a counter-revolutionary act.

Stakhanovism, on which the Government counted to increase labor productivity and reduce costs, has been a disappointment if not an actual obstacle at Soviet industrial development. This system, in which there is division of labor and rationalization, together with the plain speed-up, was devised to increase the production of star workers. It brought high wages to these “Stakhanovists” under the Soviet graduated piece-work scale, but by giving Soviet industries an excuse to increase the “norms” of a day’s work for everybody, it was expected actually to reduce production costs per unit. Theoretically it was perfect.

The norms were increased and wage scales per unit were thereby reduced. But Stakhanovism has entailed an amount of “paper work,” and it is coddling the Stakhanovists, which has increased costs and has laid the way open for favoritism, angering workers who are in no position to become Stakhanovists.

Production has fallen in the Don coal basin, where Alexei Stakhanov himself works. Stakhanovism was applied to machines as well as men. When higher production could not be attained by men’s efforts, machines were speeded up, often beyond their capacity, and engineers who protested were denounced. Costly breakdowns resulted.

But having launched Stakhanovism with trumpets and hosannahs, the Kremlin could not admit the policy itself was a failure. In the early days of socialized agriculture when peasants—forced willy nilly on to collectivized farms and deprived of their bread and meat by Government requisition or wrested from their families and sent into exile as kulaks because they had the wit to prosper a little—passively revolted in a form of the sit-down strike and threatened to starve the cities as well as themselves, Stalin called a halt. He sternly rebuked subordinates in March, 1930, in an article entitled “Dizziness from Successes” for overzealous application of a good policy.

So now Stakhanovism has been launched for another year and failures are being laid to the faulty application of Stakhanovism, not to Stakhanovism itself. So in industry generally, it would seem, the regime has found it necessary to find a scapegoat for faults inherent in the system. “Trotskyist wrecking” is an excellent one, for very likely there is a certain amount of that.

The third factor in the purge—the internal political situation and the apparent relation of the new Soviet Constitution to it—requires an article in itself.

* * *

PARIS, Sept. 14.—There is an ironic paradox in the fact that the new wave of shootings and arrests in Russia coincides with the going into effect of the new Soviet Constitution and the preparations for free and equal elections this fall. Many diplomatic observers in Moscow believe that the coincidence is not altogether accidental and that the widely heralded liberality of the new “Stalin Constitution” actually is one factor in the purge.

Among the most important sections of the Constitution are provisions for the election by popular vote in the secret ballot of all

governmental bodies up to the Supreme Council of the Union of Soviet Socialist Republics, which theoretically will be the nation’s supreme legislative and executive authority, and an elaborate Bill of Rights.

This Bill of Rights guarantees the people’s right to work, to rest, to education, and to material security, even in sickness and old age, and contains many other highly enlightened provisions. It also guarantees to citizens the inviolability of their homes, the secrecy of correspondence, and the security of their persons.

“The citizens of the U.S.S.R. are insured the inviolability of the person,” says Article 127. “No one may be subjected to arrest except upon the decision of a court or with the sanction of the prosecutor.”

Elsewhere the Constitution provides that “in all courts of the U.S.S.R. cases are heard openly, except when otherwise provided for by law, and the accused persons are insured the right of defense.”

That phrase, “Except when otherwise provided by law,” is one of several monumental jokers that cancel much of the liberality of the Constitution. What is now going on in Russia illustrates forcefully how little those guarantees of personal security mean. When a political offense or alleged offense is involved they mean nothing at all. And under this system almost anything can be construed as a political offense.

Political offenses almost always are placed before the military collegium of the Supreme Court, wherein, despite the theoretical abolition of the OGPU (secret political police) courts when the new Commissariat for Internal Affairs took over the OGPU’s duties in 1934, virtually the same personnel operates in approximately the same way as before and to all intents is still an integral part of the political police. So, for that matter, is the office of prosecutor, who, theoretically, is subject to the people through the Supreme Council, which, under the new Constitution, will appoint him.

Various sections of the military collegium, which is now traveling about the Soviet Union holding swift trials here and there, have hearings in secret unless the Government has reasons to stage a “show trial,” as it did in the case of Gregory Zinoviev and Leonid Kamenev last summer, and for Gregory Piatakov and Karl Radek last winter, with unfortunate reactions abroad that so surprised the Soviet authorities.

The trials almost invariably are held under the “Kirov Law,” decreed immediately after the assassination of Sergei Kirov, friend and associate of Joseph Stalin, which led to the terror of 1935, in which both prosecutor and defense counsel were dispensed with in terroristic cases and the right of appeal was denied.

Such trials are held behind closed doors and all the public ever knows of them are terse official announcements usually published obscurely on the back pages of newspapers. A provincial newspaper, under the heading *Chronicle*, will say that the trial of such and such persons having been held on such and such charges, they have been found guilty and sentenced and the sentences have been carried out. No word of the proceedings themselves is given and no evidence disclosed.

The political police have retained one all-important right of which little is known outside Russia. This is the right of administrative exile. The political police, without recourse to a court at all, may exile a person for five years to any place they wish. Such exile may be only from the principal cities, in which case the exiled person may lead a reasonably comfortable life and earn his living anywhere else. Or it may be to some dreaded place such as Solovetsky or some wretched Siberian camp. Such five-year exile sentences, I am told, can be renewed indefinitely, so it is possible to keep a person imprisoned, or virtually imprisoned, for life without a trial and without public announcement.

The long silence over the fate of Nikolai I. Bukharin, Alexei I. Rykov and many other once high Soviet figures has given rise to rumors in Moscow that they will not be tried—possibly because the Soviet got such a bad press abroad as a result of the earlier trials—but already have been put away by administrative exile.

Thus it is evident that the supreme Soviet authority has ample means by which to dispose of anybody it wishes despite the new Constitution.

Now as to the elections, which will be beginning in a few weeks. The elections themselves will be as liberal as any held in the bourgeois democracy. The old class distinctions have been removed. The peasant’s vote will count the same as the industrial worker’s. No one will be barred from voting or from a candidacy for any office by reason of social origin or the nature of past or present employment.

At last barriers against former aristocrats or their descendants have been broken. Even priests may vote and may run for any elective position, from membership in a local Soviet to membership in the Supreme Council. Only persons who have been deprived of civil rights by court order as a penalty for some specific crime are ineligible.

Furthermore, the people will vote by the Australian ballot instead of by raising hands in open meeting as heretofore, when any man who ventured to vote against the Communist party's ticket was immediately spotted.

Rules for the conduct of elections are strict. There is every reason to believe that the elections will be carried out in complete conformity with the rules.

These elections will be held among a people containing many undependable political elements. Not all the remnants of the aristocracy and of the bourgeoisie have yet been swept away. Bolshevism was a costly experience to them. Many have accepted it, though grudgingly, and some have become loyal to the regime. Many still hate it and some who accepted it are now beginning to wonder when the expected benefits will come and whether it has all been worth all the sacrifice.

One has to explore no deeper than the Soviet press to know that there is much discontent among the workers. The average wage is appallingly low in purchasing value and the living conditions of the average Soviet citizen are at the slum level, judged by American standards. The people are still starved for the most ordinary consumer goods, and what they can find are at exorbitant prices and usually of unbelievably bad quality.

I think some of them are becoming tired of this. It is among the young people, who have passed most or all of their lives so far under the Soviet regime and who know of conditions elsewhere only what their leaders permit them to know, that Stalin's greatest popular strength appears to lie. Everything indicates that he is pushing them into the key places of the Communist party, of the Government and of industry in order to supplant older persons whose personal loyalty may be subject to question. And the young people will offer a tremendous voting bloc, especially since both men and women become eligible to vote and hold office at eighteen.

So we see young people being cultivated and mobilized and older people being sidetracked, dismissed, and arrested. The casualties have been especially heavy among intellectuals and political theoreticians.

Religious organizations and practitioners are coming under special scrutiny by the political police, though whether this will reach the dimensions of a purge is not yet clear. Recently there have been arrests of numerous religious people on charges of constituting espionage centers for foreign Powers, and occasional warnings against their activities appear in the Soviet press. Accounts of arrests tell of former aristocrats and former landlords going on trial along with bishops, priests, and former nuns.

Under the new Constitution religious people have a right to freedom of worship, though not to make religious propaganda (whereas the right to make anti-religious propaganda is specifically reserved) and the authorities have expressed concern over the activity of religious people in electioneering for local Soviet posts.

The Communist party, the Government, and anti-religious leaders have warned, however, that efforts to checkmate religious activities should be by propaganda, not by executive measures. From a purely Soviet viewpoint, however, religious organizations containing so many of the older elements whom bolshevism has ruined are the most likely to be nests of anti-Communist and anti-Stalin sentiment, and hence the attention the political police have now given them is not to be wondered at.

Thus we have a picture of the Soviet Union preparing for its first secret elections, at the same time combing the whole population for remnants of the old opposition to Stalin. There is a strong suspicion in Moscow that the election campaign and the purge are related. With everyone who has ever opposed Stalin dead, exiled, or imprisoned, the election can be held in perfect safety. Nor is it likely, either, that unknown disapprovers of the present regime will venture in very large numbers to vote against the regime's wishes, even on a secret ballot.

* * *

PARIS, Sept. 15.—So much of the news coming from Russia in the last year has been so shocking and depressing that the brighter aspects have been overshadowed. The Soviet Union is not the

paradise of sweetness and light portrayed in propagandist publications abroad and in the broadcast in many languages sent nightly from Moscow's powerful Communist International station. But neither is it the fearsome place painted by Fascist enemies abroad.

Red Russia is an astonishingly contradictory country. So many items in the picture are admirable. The ideal that fathered the Soviet—the emancipation of mankind from all exploitation and the winning of universal freedom—is nobly grandiose. But in twenty years the revolution has made so little progress toward emancipation—if it has not, indeed, retrogressed—that the Soviet worker is among the most exploited in the world, and there are few peoples having less freedom than the Russians of to-day.

Nevertheless, there seems to be no doubt that the lower categories of Russian labor are decidedly better off than they were before the revolution. They have little now, but they had nothing then. And their condition now is steadily though slowly improving.

From a material standpoint the Soviet regime has much to boast about, even though its manufacturing and distributing systems are still extremely backward in comparison with advanced capitalist countries. With all shortcomings admitted, the industrialization program is one of the greatest efforts in human history.

From a cultural standpoint the Soviet can point to many fine achievements and appears to have made a far better showing in that respect than the Fascist regimes.

From a moral standpoint and from the standpoint of spiritual and ethical imponderables (which, however, are extremely real and precious things) the Soviet regime has been disastrous.

The Soviet regime, through the official press, itself has revealed so much of the industrial inefficiency and waste—accounts of which have been cabled to the United States by this and other correspondents—that there is no need to dwell on it here. But these faults—for which no effective remedy is yet in sight, though many have been tried—impose a crushing weight on the average Soviet citizen.

All this inefficiency holds down the wages that the Soviet can pay—and it, like any capitalist employer, must make a profit or go out of business—and enormously increases the cost of everything the Soviet citizen buys. It makes his real wage extremely low. And the quality of almost everything he buys is so bad that the goods could not compete with capitalistically produced goods for a minute in any free market. With the Soviet monopolizing foreign as well as internal trade, the Soviet citizen must take what he can get and like it.

In the matter of rent the Soviet citizen is better off than a low-paid worker in a capitalist country. In Russia the State owns every foot of land, so there is no expensive ground rent to pay. The rent, furthermore, is calculated according to the tenant's earnings, with the low-paid worker paying little.

For these reasons the Soviet worker pays a smaller part of his earnings for a place in which to live than most workers under capitalism. But, in general, he lives in a worse place because of the chronic housing shortage in Moscow and in other rapidly growing industrial cities.

In one enormously important respect Soviet workers are better off than many workers in capitalist countries. There is no unemployment problem in Russia. Soviet propagandists abroad make much of this fact. Everybody capable of working and not politically suspect can get a job, though not necessarily the job he wants.

But this fact is not due to any merit of the Soviet system now, though that system should be able to prevent unemployment even if industry catches up with the consumers' needs. Since the State, except for trivial exceptions, is now Russia's only employer, it can simply reduce the hours of work if the saturation point is ever reached and spread the available work over the whole population.

There is no unemployment now simply because there is a constant labor shortage. The Soviet's expanding industry under the Five-Year plans cannot get enough workers. The labor shortage has been made more acute by the fact that inefficiency, bureaucracy, and the prevalence of parasitic functionaries have greatly reduced labor productivity. Foreign engineers have estimated that four times as many persons, or more, are required under Soviet conditions to turn out a given production as are required in the United States. It will be many years before that is remedied—if it is ever remedied.

In exploration and in some branches of science the Soviet system has accomplished wonders. Such a breath-taking exploit as, for instance, the landing of a party of scientists with equipment at the North Pole could not have been carried out except by the

might of a thoroughly co-ordinated organization with the whole resources of the Government behind it.

Similarly the Soviet Government lavishes support upon science. Geologists are scouring the Soviet's whole vast domain according to a coherent schedule to discover more natural riches. Archaeologists are unearthing ancient cultures, from the stone age to Scythian, Greek, and Byzantine settlements.

The Soviet scientist is one of the most favored men as long as his subject in no way infringes on any political doctrine. But if it does, even remotely, he may get into trouble.

The Soviet has pursued a highly enlightened policy in regard to music, the theater and to a certain extent literature. One of the wonders of the revolution is that even in the darkest days, in the midst of hunger and chaos, the Soviet regime did not permit Russia's magnificent theater and ballet to perish, but steadily nurtured them. Now it pays stipends to enable promising youths to study acting, music, and dancing—indeed, all the arts.

There is a range and vitality to the Soviet arts that is far superior to the fare available in Germany, for instance. Yet, as in Germany, the Soviet theater is largely presenting classics. Few original works of value have appeared since the revolution.

In the arts, including literature and the drama, the Soviet practitioner need not produce propaganda. He can win glory and wealth with a simple and honest portrayal having no political content whatever. But if it has any political content it would better be exactly right.

On the other hand, the Communist party presumes to dictate what is good art or music or architecture or theatrical direction and it can wreck a man's career with a word. Thus, Dmitri Shostakovich fell overnight from his eminence as the Soviet's most favored composer because some one in authority disliked his music.

The Soviet's efforts in education are worthy of the highest praise. Illiteracy, which was high before the revolution, has been almost entirely overcome. The system of stipends enables many bright youths to obtain higher education. This is especially effective in industries, where a system of instruction—from spare-time courses to higher full-time technical schools—enables capable workers to rise from the ranks to executive positions. There are not nearly enough such stipends, and, according to Russians, there is much favoritism in their bestowal. Nevertheless, the system itself is admirable.

Soviet higher education is below the standards of the universities before the revolution, but the extension of education to the broad masses has brought up the average educational level. And, naturally, education is heavily loaded with politics, for Soviet youth must be reared in orthodox Stalinist belief.

Other cultural and recreational facilities exist to a greater or lesser degree for the Soviet citizen. Many of them, such as the vaunted rest homes and sanatoria, are so inadequate in number, however, that their use is restricted to favored categories or lucky individuals. There is every indication that the Kremlin would like to bestow the greatest material, cultural, and recreational benefits on the whole population and that it is doing its best to improve the lot of the workers. But the demands on Soviet resources are immense and pressing.

Conceding what I believe to be true—that the Soviet regime is sincerely doing all it can materially for the people as a whole—it has, nevertheless, utterly eradicated freedom of expression on any except the most innocuous topics and has made even freedom of thought a dangerous luxury. In this it is only conforming to the inevitable pattern of dictatorships, be they royal, Fascist, or proletarian.

The result is an intellectual servility, a sycophancy, a hypocrisy that is simply degrading. Persons in prominent positions have to toe the line. Such persons not only must refrain from the slightest criticism of any decision made by the Government or by the Communist party, which rules the Government and in turn is ruled by Joseph Stalin, but they must express the most fulsome praise of such a decision.

Whenever an important occasion arises factory workers are called together in meetings organized by the Communist party to discuss the situation and to vote an appropriate resolution.

"What do you think, Comrade Blank?" asks the party leader. Whereupon Comrade Blank dutifully expresses his admiration and gratitude for the Government's course. No one would dream, whatever his personal opinion, of expressing anything but the correct view or of voting against the resolution.

That is how these floods of bloodthirsty resolutions are evoked from workers in every part of the country when a group including a leader like Marshal Mikhail Tukhachevsky is suddenly placed on trial. Such resolutions have no meaning at all except to show what the Government intends to do.

The best example of synthetic "public opinion" was presented last year when the law making abortions illegal and granting pensions to mothers bearing eight or more children was presented to the people for discussion. There has seldom been a more unpopular law. Because of certain peculiar circumstances in Russia it practically doomed most women to child-bearing. Yet there came the same inundation of ecstatic resolutions and letters from workers, scientists, and premier ballerinas floridly thanking the Government and Stalin for his loving care of mothers and children.

The guarantees of freedom of the press, of assemblage, and of street demonstrations under the new Constitution are meaningless. The catch is that such freedom must be exercised in the interests of the working class. The sole judge of what constitutes the interests of the working class is the Communist party, which means the Stalin regime.

There is no longer freedom of discussion even within the ranks of the Russian Communist party, though it was originally intended that members of this "vanguard of the toiling masses" should debate policies with utmost freedom until the party had voted its "line," after which all must accept it. But there has been no party congress since February, 1934, and there is no indication that one will be held in the near future. Meanwhile, the country and the party are faced with some of the most momentous problems in their history.

The most complete brake on freedom of expression is the ubiquitous and well-nigh omnipotent political police. Persons have been sent to prison or to exile for some remark, made at a private party, that a secret agent there among the guests construed as disloyal. When the people speak at all of any touchy subjects they speak in whispers. And this uncertainty as to when one may be denounced as a Trotskyist or as a spy is intensified in the current purge, with the Government calling on the entire population to watch neighbors and fellow-workers.

* * *

PARIS, Sept. 16.—Soviet Russia has succeeded to the extent that she has—and the successes in many fields are great, indeed—because her present system, as now administered, is the antithesis of communism, which is her ultimate ideal.

True communism would be a variety of anarchy, a condition in which a State had "withered away," and, all means of production belonging to the whole people, a society simply would be one gigantic co-operative running itself without supervision of officials, soldiers, police, or industrial managers.

In Soviet Russia, on the contrary, the State, far from showing the slightest signs of withering away, is the strongest and most absolute in the world, with unlimited power vested in a little group of men headed by Joseph Stalin who manage every detail of the country's life down to the last spool of thread and the last shoe lace and steadily push their people along the path of industrialization and collectivization.

They accomplish this through the medium of government officials and industrial managers, who must be entirely subservient to their will. They are fortified in their power by the largest army in the world and by a ubiquitous police apparatus, which differs from such apparatus in capitalist States only in that it is more extensive and has a power of interference in every phase of the people's lives that is approached only under fascism.

One hears much less of communism in Moscow than in New York, Berlin, London, or Paris. The word itself is seldom heard except in reference to the Communist party.

Communists, of course, do not pretend that communism exists in Russia. Pure communism, as conceived by Marx, Engels, and Lenin, is the ideal for an indefinite future—a future that appears to be receding. What exists in Russia now is communistic only in the sense that it is State socialism—namely, ownership, by the State of the means of production and distribution—which Marxians consider the first or lower form of communism, a transitory stage on the path to true communism.

What we have in Russia to-day is startlingly like capitalism, containing many, though by no means all, of the evils of capitalism

and presenting even an intensification of some of those evils, in addition to having evils of its own.

The greatest difference between any capitalist State and the Soviet Union as it stands now is the fact that in capitalism there are many employers, in the Soviet Union only one (except for such insignificant individual enterprise as still remains), and that is the State itself. And the State has proved that it can be as hard a taskmaster as any capitalist boss and can enforce its will with a police power infinitely stronger than any coal or iron police or venal "company" sheriff in the United States.

"Surplus value," which is one of the foundation stones of Marx's philosophy—the amount that the worker gives the employer in labor above what is received—is exacted in the Soviet system too. In Russia that surplus value is being used to extend capital construction, to build up a military establishment and to maintain a swollen army of bureaucratic functionaries who probably consume more of the workers' toil than the proprietor class in capitalism. An abnormal amount of surplus value must be extracted from the worker because of the inefficiency and waste under a system of Marxian socialism, which endeavors to put all production, small as well as large, in the hands of the State.

Yet in general the form of the system now in force in Soviet Russia fairly well follows the program suggested for State socialism by Marx and Engels in the epochal Communist Manifesto.

The chief items of their program included abolition of all private ownership of land, imposition of a heavy income tax, centralization of all banking operations in a monopolistic State-owned bank, concentration of the means of transport in the State's hands, extension of the means of production by the State, and abolition of all inheritance rights.

The Soviet system, as now constituted, has carried out or has gone far toward carrying out all these measures except that of abolishing the rights of inheritance. Rights of inheritance are now even specifically protected in the new Constitution. That in itself is a great recession from early Communist ideals and is one of a number of tendencies making for the stratification of the population along lines reminiscent of classes in the bourgeois world.

Another great recession that has received little attention is the provision of the new collective farm statute of 1935 permitting individual members of collective farms to till individual garden plots, raise a limited amount of livestock, and keep the profits for themselves.

But though the present Soviet State is complying literally with most of the principles laid down by Marx and Engels for the transitional period, in detail it is radically different in many respects from the vision of the founding fathers.

Bolshevik writings at the beginning of the revolution, including Lenin's *State and Revolution*, show that the Bolsheviks underestimated the task of establishing a Socialist State and especially underestimated the complexity of modern manufacturing and distribution, and that underestimation is at the bottom of many troubles.

Industry seemed to them a simple matter, management consisting of little more than bookkeeping, that any literate worker could do, the only real skill required being that of engineers and technicians, whom the new proletarian masters could hire just as capitalists had hired them. And with the exploiting bourgeois owners done away with, the Bolsheviks believed there would be a release of production forces that would substantially increase the output.

Similarly it was expected that the workers themselves would take over governmental functions with equal simplicity, displace the hordes of privileged bureaucratic functionaries, and organize a "cheap government."

Once the exploiting classes had been ousted, they believed the army and the police could be abolished and their functions exercised by armed workers.

Partly because the functions of management were regarded as being so simple and partly to prevent the formation of a new privileged bureaucracy, it was intended that Government officials and industrial executives should receive no more pay than ordinary workers. Though Marx and Lenin both said that inequality in pay was permissible, they hardly could have conceived the great spread prevailing between the highest and the lowest in Russia to-day.

How different in many ways is the present picture from those early ideals. In Russia there is no contrast so great as that between J. P. Morgan, say, and some poor devil of a Bowery sandwichman,

but the contrast between a favored playwright receiving as much as two hundred thousand roubles a year and a scrubwoman receiving less than one thousand roubles is great enough. One has only to see the trim, neatly painted two-story bungalow of a certain commissar in fenced grounds beside the Moscow River and to see four persons sleeping in one room, as one can any evening within a five-minute walk of my own Moscow apartment, to realize that socialism, too, has its haves and have-nots.

In the place of ordinary workers exercising power, as originally conceived, we see a self-perpetuating caste of officeholders chosen from the Communist party or beholden to it. The Soviet regime tried in its early days to keep their earnings somewhere near those of ordinary workers by establishing a "party maximum," and forbidding party members to receive more than six hundred roubles monthly. That has been long since abolished.

Still, the earnings of political officials are not excessive by capitalist standards. The actual money salaries for higher-grade officials probably average around one thousand roubles monthly, though precise figures are not obtainable. But their earnings are large compared with the average industrial wage of 251 roubles monthly, the last available figures. Many Soviet officials supplement their earnings—though I am told that Stalin does not—with payment for speeches and articles. Officials do not need large sums of money. Fine foreign cars are at their disposal. They live simply but comfortably in apartments, of which they have the pick, and in country bungalows through the hot months. They are not greedy for money, and the higher circles are singularly free from graft, though corruption still occurs among minor functionaries.

Officials' earnings are far below those of successful authors, journalists, actors, and musicians, who are at the top of the economic scale, and below those of engineers, whose earnings are sometimes several thousand roubles a month. Next comes the white-collar category. Aside from the Stakhanovists, some of whom earn as much as two thousand roubles a month, the manual worker is at the bottom of the pile.

A striking differentiation in earnings and in the nature of work is producing a budding class consciousness. One finds white-collar workers forming a new middle class of their own, considering themselves distinctly superior to manual workers. Workers are trying to climb up to the white-collar category.

The Communists themselves contend that inequality in monetary reward does not mean that classes are being formed as in bourgeois countries, because State ownership of all means of production prevents the formation of dynasties founded on ownership of land, railways, etc., as in capitalism.

In Soviet socialism only savings and personal property which can include a house or an apartment, but not land, can be handed down. But the children of the Soviet's wealthy enjoy distinct advantages over those of ordinary workers.

Now there is nothing in Communist doctrine against an individual owning property. An individual is forbidden only to profit from the labor of others. The Stalin regime, therefore, is applying every bourgeois stimulus of higher pay or higher service bonuses and the like to get the utmost production from the people. This is not motivated by any desire to compromise Communist ideals, but has been forced on the regime by the realities of the situation, by the necessity of making Soviet industry work and of keeping it working.

* * *

PARIS, Sept. 18.—For all the cries of treason, spying, counter-revolutionary plotting, and sabotage that the Soviet authorities are raising on all sides as they prosecute their purge, it is probable that Joseph Stalin is more firmly fixed in the saddle than ever before.

The renewed assertions that Russia is on the brink of another revolution, this time anti-Bolshevik, which the purge is evoking from some hostile critics abroad, find no support on the scene, even though the Soviet Government gives some excuse with accusations this or that group of "enemies of the people" is scheming to restore capitalism and is even arming peasant groups for that purpose. In Moscow one finds no expectation of any overt act to overturn the regime, even among representatives of nations that would delight to dance on bolshevism's grave.

According to general opinion in Moscow, the only conditions under which the Stalin regime could be turned over—and most of these are considered absolutely impossible and others highly improbable—would be the following: An uprising of the Red

Army, a "palace revolution" of Communist party leaders to wrest power from Stalin, a spontaneous uprising of the people, a collapse of industry so severe as to drive the people to desperate steps, a disastrous foreign war, or the death or disability of Stalin.

But first there is no indication that the Red Army has been shaken in its loyalty to Stalin, despite the shock dealt to it by the execution of Marshal Mikhail N. Tukhachevsky and seven fellow-generals. Furthermore, the army has been brought completely under the domination of the Communist party through replacement of individual military command by command through political commissars answerable and presumably absolutely loyal to Stalin.

In the second place, no leaders are visible whom one could imagine leading a Communist party *coup d'état*. The succession of purges has removed every old ideologist and every one-time leader with a personal following or influence. There are left in posts of authority only men of tried personal loyalty to Stalin holding their places only by his favor. Any one of them would disappear, as many highly placed figures already have disappeared, the moment there arose the least doubt of his complete loyalty.

Thirdly, for all the discontent one feels and of which there is sometimes concrete evidence in official exposures of working conditions, it is simply impossible to picture the Russian people indulging in anything more counter-revolutionary than sporadic, disunited, passive resistance, as when at quite badly conducted factories workers in droves play truant from work or defy foremen. They are not an explosive people; they are stolid, enduring and thoroughly trained in obedience, and they see many of their conditions as improving. Furthermore, the Soviet population contains an abnormal percentage of young persons, among whom loyalty to Stalin is strongest. Even if the people wished to revolt, who would lead them? And it is unthinkable that any dangerous trend could develop without the political police discovering it and pouncing on it. As far as one can see, the only active dangerous discontent has been among the old ideologists, and they are gone now.

Fourthly, even with industry working badly, it is far from the breakdown stage. There is no reason to think it will not be able under constant driving to keep the country going.

Fifthly, a foreign war might bring disaster and certainly would strain the Soviet machine to the utmost, but the Soviet is taking no chances and will do its utmost to keep at peace.

Finally, even Stalin's death—and he looked well when I last saw him a few weeks ago—is not likely to mean the end of his leadership. The general belief is that his mantle would fall on Andre A. Zhdanov, the Leningrad party leader and successor of Sergei M. Kirov, who was "crown prince" until his assassination. Mr. Zhdanov is a thoroughly Stalin man and presumably would carry on Stalin's policies if he succeeded him. A slip in the transfer of leadership to Mr. Zhdanov in the event of Stalin's death or disability is difficult to imagine with Nikolai I. Yezhov, a Stalin zealot, controlling the political police and possessing great power throughout the party and apparently considerable over the Red Army also.

But, although Moscow observers expect no brusque changes in the Soviet system, there is some excuse for believing on the grounds of past performances that it will undergo gradual subtle modifications, though hardly enough to change its basic structure.

It is a fundamental tenet of Communist philosophy that capitalism carries within itself the seeds of its own destruction, a tenet that came uncomfortably close to realization during the depression. Many foreigners long residents of Moscow are finding in events of the past year grounds for wondering if it cannot be said also that communism carries within itself the seeds of its own destruction.

Twenty years is too short a period for categorical judgment as to whether a new political and economic system will or will not work, but it is long enough to show significant symptoms.

Much thought abroad blames Stalin for the ills now afflicting Russia. He, of course, is responsible for the purges that have been and are being carried out with a severity shocking to Western minds and—it seems to us who have known well some of these men who are disappearing and never dreamed they were less than devoted Bolsheviks—with indifference to individual rights.

But, Russia being Russia, is always a land of intrigue and espionage under rulers in whom there is often a strong flavor of the oriental, there is no assurance that the dictatorship would have been more gently conducted by anyone else during the past ten years of

terrific striving in a system where the individual must be subordinated to the State.

And since this period has been one that required above all supple practical leadership to meet urgent practical problems, many in Moscow who deplore Stalin's ruthlessness nevertheless feel that he has built up the country with extraordinary skill and foresight to face the danger of war, which now justifies the terrific tempo of the industrial program. His problem has been one of running a vast nation in a difficult period, not merely of spinning theories.

Basically Russia's ills may better be attributed to the principles according to which the Soviet regime is attempting to shape her development. The most important of these ills are: First, the low production, bad quality, chaotic distribution and high prices of nearly everything it makes and the low wages it pays ordinary labor for making them; second, the lack of intellectual liberty and freedom of expression or even assurance against unjustified arrest, and third, constant application of police power in attempts to improve the operation of the economic machine and the hunt for heretics.

In endeavoring to place all production and distribution, including the most trivial consumer goods, in the hands of the State so as to wipe out exploitation of the workers by capitalists according to Marxian principles, the Soviet regime seems to have bitten off more than it can chew. The men who are now running Soviet Russia are capable and practical, but it would seem that a group of men competent to conduct the entire economy of a vast country as one unit could not be assembled from the whole world. It would seem also that the most overwhelming police power is not so effective in producing an adequate supply of good goods as old-fashioned bourgeois competition which the Soviet tries with scant success to match with "Socialist competition."

Soviet industry functions well at points where real competition enters. Such points include production of airplanes and military equipment. In these the Soviet is in what might turn out to be life-and-death competition with the outside world. Her planes, tanks, and guns must be good; therefore they are good. In consumer goods there is little at stake. The Soviet Union will not totter if the Soviet-made shoes for which Ivan Inanovich pays half a month's salary soon go to pieces, if matches will not light, or if stores carry electric fans and bathing suits in the winter and electric heaters and ski suits in the summer.

Furthermore, the stamping out of all private manufacturing enterprise necessitates the application of police power to a large part of the population, because it stifles age-old individualistic instincts. There must be constant watch lest some little entrepreneur establish a hole-in-the-wall factory or endeavor to make a profit by cornering wanted products and peddling them.

Even closer supervision of the people's thinking is required under this system. Communism is a body of dogma that has been subjected to changing interpretations, like the dogma in the formative periods of the Christian religion. Infidelity and heresy are the blackest of crimes because they threaten the very foundation of the State. Therefore they must be hunted down mercilessly. And that requires an army of spies, both paid and voluntary.

With the entire economy being conducted like one great plant and with an error in judgment likely to be construed into "Trotskyist sabotage," there is a setting for a tremendous bureaucracy, both of clerks to attend to the mountains of paper work piled up by executives dodging responsibility for safety's sake, and of Communist party functionaries and trade-union personnel, who add parasitic costs to production. The Soviet worker must carry these on his own back.

Early Communist theorists had no illusions that freedom would have any place in State socialism, conceived as a transitional stage in the march toward true communism.

"As soon as it becomes possible to speak of freedom, then the State as such ceases to exist," wrote Engels.

And this period must last indefinitely until the people have been trained in new habits of thought—a matter of generations. Communist writers are exceedingly vague about the duration of this dictatorial transitional period, but from the vantage point of twenty years' experience that goal has receded beyond the horizon and is seldom even thought of in Moscow.

Closer to the heart of the Soviet's troubles than anything else perhaps is the fact that intolerance, hatred, and terror are integral parts of the whole doctrine. Can a worth-while culture grow from such seeds?

(Continued on page 97)

We Love A Crusade

By GEORGE FIELDING ELIOT

(Here is an article, published in *The Saturday Evening Post* of February 5, 1938, that presents a sheerly realistic American viewpoint and seeks to analyse costs and consequences for the American nation should the United States drift into a war in the Pacific. The author was formerly Major, Military Intelligence Reserve).

* * *

WARs begin when diplomacy has failed. It has even been observed by some cynic that war is merely the extension of diplomacy into the realm of force. Almost every major authority on the art of war discusses the influence of diplomacy, of state policy, on the conduct of hostilities; but these discussions assume that a war is already in progress. Thus, while it is generally recognized that diplomatic and political considerations must be and are given the most careful attention by commanders-in-chief in war, it is less widely realized how much strategical considerations must affect the peacetime policy of states, and what close liaison must be kept up between responsible statesmen and their military and naval advisers, even though no war be expected.

Still less does the ordinary citizen, in those happy lands where the ordinary citizen—in mass, at any rate—still has something to say about the policy of his country, consider it his affair to inform himself as to the possible military implications of any particular idea as to foreign relations which he may happen to entertain. He may even so cherish his idea as to write letters to his newspaper or to his congressman urging his views, or join in enthusiastic mass meetings at which canned resolutions are adopted insisting that his government do this, that or the other thing in behalf of some oppressed people halfway around the globe, with a happy disregard of inevitable consequences.

Americans are particularly given to this sort of thing—always, of course, with the very best intentions. We like our mental pictures of foreign squabbles done in black and white, with sharply defined lines between villains and heroes; or, in the modern phrasing, aggressors and victims. "We Americans," as W. E. Woodward remarks, "cannot conceive of a war without a suitable moral background." We love a crusade. We love to take sides.

The Word-War about Peace

Let any sort of war, or hostilities—for war is no longer acknowledged under its proper title; this being another of the innocent little fictions with which the post-1918 ideology torments us—break out anywhere in the world, and immediately our American welkin rings with the clamor of self-appointed committees for the relief of this and committees for the support of that, while from each of our innumerable peace societies come shouts that unless its particular scheme for assuring peace is immediately adopted, this republic will find itself involved in war the day after to-morrow.

Isolationists demand that we crawl into a hole and pull the hole in after us; internationalists insist that the best way to keep out of war is to interfere in other people's affairs; and some of the exhorters on either side are so persuasive that it is difficult to realize, while listening to their beautiful, though mutually destructive theories, that if any one of those theories were actually to be put into practice, any trifling chance which the United States may still have of remaining at peace in case of a major war would be gone for good and all.

Underneath all the tumult, however, the ordinary American citizen has one firmly rooted idea, which, the writer of these lines is convinced, would get something like a ten-to-one vote if it were put to a national referendum—and that is that the United States ought to stay out of other nations' wars. The difference of opinion is concerned with the best method of accomplishing this object; discounting, of course, the disproportionate noise created by individuals with special non-American axes to grind.

Having talked with a good many of the leaders of the various peace movements in this country—you can't say the peace move-

ment, because there are half a dozen passionately antagonistic ideas as to how peace is to be assured—I am sure they, too, have at least one thing in common—not one of them has the smallest idea of the military ingredients required by his particular nostrum; while most of them are convinced that military men—they refer to such persons, en masse, scornfully, as "the Generals and the Admirals"—are burning with anxiety to start another war so that they may try out new weapons and achieve glory.

The true function of military and naval staffs toward the foreign relations of the country—that of providing, when required, technical advice as to the military factors in any conceivable situation which might come about as the result of a certain policy—is little understood either by our peace advocates or by the public at large. The truth is that, almost invariably, the military influence on American foreign policy has been conservative. It tends to season the political stew with a few grains of salt. Not one of our foreign wars has been brought about by the intrigues of a military caste; in fact, we have entered upon each of them shockingly unprepared in a military sense, and in each case that fact has been urged, in advance, by the military men upon their superiors, and in some cases upon the public. Unfortunately, however, while it is permissible for officers of the Army and Navy to urge reasonable preparedness as a general policy, it is not within the bounds of propriety for them to focus their public utterances upon any particular situation.

Yet there was, perhaps, never a time in our history when sound military thought needed to be more widely disseminated to our citizenry. There was never a time when the individual citizen needed to weigh more carefully his attitude toward foreign affairs.

As an example of this, one which is before us at this moment, let us examine the demand for a boycott of Japanese goods by the ultimate American consumer.

This crusade is being earnestly pushed. Clubs are being formed to carry it on; lists of Japanese merchandise are being published to guide buyers, and it is reported that the effect is already being felt in Japan. As well it may be, for the United States is by far Japan's best customer. We took about 30 per cent of her total exports in 1935, two and one half times as much as her next best customer, British India, to which her exports have now, by the way, been materially reduced. More specifically, during the three and one half years ending June 30, 1936, we absorbed 86.2 per cent of the total Japanese exports of raw silk, her principal export item. During the same period we took about one-third of her toys and her pottery products and almost one-half her tea. It is obvious that a sharp falling off in such a trade as this may seriously impair the economic status of a nation so dependent on foreign commerce as is Japan. This the advocates of boycott clearly perceive, and since their object is to injure Japan, to weaken her in her present contest with China, they look no farther. It is necessary, however, to look farther. It is necessary to inquire what the ultimate consequences of this policy may be, both as regards Japan and as regards us.

Boycott, like all other forms of external economic pressure, works very slowly. Even the most extreme form of such pressure—naval blockade—could not reduce either Germany or the Southern Confederacy until after four years of bloody struggle. The ingenuity of the human mind in finding ways of doing without things previously regarded as necessities, or finding substitutes for them, seems almost unlimited; and the resources of a great nation brought to bay are likewise quite beyond the imagination of those who like to deal in neat little charts and curves. And as for finances, lack of money does not seem to be a deterrent to military aggression: if that were so, there would be no Italians in Ethiopia or Spain, and Germany would weigh as nothing in the military scale. Hence the boycotters need not anticipate prompt results, as far as rescuing China is concerned, from their operations. What they may reasonably anticipate is a very great increase in Japanese irritation toward this country; an irritation which may bear most unpleasant fruit when, if Japan succeeds in reducing China to vassalage despite

the boycott, the final political and commercial status of Eastern Asia becomes a subject for international discussion.

The Futile Brussels Conference

We are, however, an impatient people. We like to get things done. We become easily annoyed with a policy which fails to produce prompt and satisfactory results. And there are many voices now being raised in this country for some form of international co-operation to deal with such aggressions as that which the Japanese army is now carrying out in China.

To those who raise this cry, President Roosevelt's speech at Chicago, in which he called for the "quarantine" of such disturbers of the peace, gave vast encouragement. But the inglorious and somewhat farcical conference at Brussels, in which we took part, did not help China; in fact, about its only result was to make the participants look rather silly in the face of cool Japanese defiance.

Brussels is but one of many proofs that international co-operation, or collective security, or whatever else its proponents may call their idea of policing the world, is of no avail whatever unless it be backed by force sufficient to compel aggressor nations to cease and desist. Words will not stop them; moral suasion will not stop them; only force will. If we have not learned that lesson in the past fifteen years, then we are incapable of learning anything at all in the rough school of experience.

Now, in the Pacific area, there are just two instruments of military power there present which can actually do anything to stop Japan's course of conquest in China. One of these is the Soviet far-eastern army, and the actual power of this army and the intentions of its government remain, at the moment of writing, a complete mystery to the rest of the world. The other is the United States fleet. Neither Great Britain nor France can, at the present juncture or within the foreseeable future, send to the Pacific any considerable portion of their naval power. The situation in Europe is too tense for that, and Japan's allies, Germany and Italy, are building new ships and new fleets of airplanes too rapidly: and may be relied upon to do all they can to help Japan by way of keeping the international pot boiling in the Mediterranean and Central Europe. Therefore, if international co-operation to stop Japan is to become a reality, the force which lies behind it and gives it substance can only be the United States Navy.

The Effects of Boycott

But wait; we were talking only about boycotts, not about naval operations. Boycott doesn't require battleships. It is a policy of peaceful pressure. Yes? Let us examine this peaceful pressure a little more carefully.

To begin with, the very fact of participation against Japan is evidence that the participant has decided that something ought to be done to stop Japan, and is, therefore, doing his or her little bit. The mental attitude thus induced, combined with our national impatience with a slow-acting policy, makes it easy to take the next step—which might well be a Government embargo on exports to Japan, perhaps under the Neutrality Act, perhaps under special legislation directed to that specific purpose.

Certainly we have had enough denunciations in the public press of American merchants supplying Japan with the sinews of war to destroy helpless China. Certainly the Neutrality Act itself contains provisions which could be applied to establish a virtual embargo on exports. And certainly the boycott idea is but the first step upon the road to such an embargo. As *The Nation*, one of the most earnest advocates of boycott, put it editorially: "Such a boycott, if widely applied, is the best and perhaps the only assurance of subsequent government action."

It is no wild imagining, therefore, to suppose that such an embargo may become a fact. Suppose that an embargo on exports to Japan is established, either by special law or by invoking the cash-and-carry provisions of the Neutrality Act, which, with the present demands on Japanese shipping for military purposes, would come to much the same thing. What will be the result?

Proudly the advocates of this policy point to certain ominous figures. They tell us—and accurately—that Japan is gravely deficient in many raw materials needed for her industry, and that the United States supplies her in normal times with vast quantities of these materials. But here again they do not consider the military angle of their argument. They do not consider the vital question

of what materials are necessary for the prosecution of war, and what only for peace time industrial operation. The idea, from their viewpoint, is to stop a war, to save China. Temporarily crippling Japan's ordinary industries will not do that; the Japanese, with the vast prize of exclusive control of Chinese markets and Chinese raw materials all but within their grasp, can afford to tighten their belts and endure for a considerable while, with certain mental reservations as to vengeance when China is theirs.

But if Japan be deprived of raw materials immediately necessary for the prosecution of war, there will be a different end to the story.

Here again we must take the military slant. Such materials, in the parlance of industrial mobilization, are called strategic raw materials.

Normally, the Japanese Empire imports a large part of her iron ore from Central China and from Japanese-owned mines in Malaya; she produces only about 10 per cent of her consumption of petroleum, and has almost no lead, rubber, nickel and aluminum. These are her most serious munitions deficiencies. As for cotton, industrial stocks already on hand will take care for a long time of purely military requirements if relieved of the commercial demands of the export trade.

First, then, must be considered iron, the basic element of munitionment. The Anshan mines in Manchuria and the Korean deposits supplemented by domestic production and by the "iron and steel self-sufficiency" plan begun early this year, which includes the application of German processes for treating low-grade ores, can take care of immediate necessities. Japan's drive in North China has given her possession of the enormous iron deposits of Chahar, at present only crudely worked. Toward these mines, from Jehol, a railway is now creeping, mile by mile; Japanese mining engineers are already planning the exploitation of these deposits, and production can be expected on a large scale by early summer of 1938. Finally, to take up the slack, there are the truly enormous war reserves of pig iron and scrap steel which have been assembled in Japan.

Japan's Dutch Cupboard

Lead, nickel and aluminum are not items which are required in vast bulk for munitions production; the war reserves will take care of these items for some time. But petroleum and rubber remain.

The consumption of petroleum products by a highly mechanized army such as Japan has pushed into China, and by an air force, always runs far ahead of peacetime estimates; and there must be kept in hand an ample reserve for the fleet, against the hour of need which may come at any time. This means but one thing: The flow of oil from outside sources must be kept up. The reserves, calculated at eighteen months' supply, will not last that long.

Now, the principal source of Japanese crude-oil supply is the United States. We furnished 58.2 per cent of her imports of crude oil in 1933, 66 per cent in 1934, and 76 per cent in 1935. In refined oils, however, there is another story, and the figures here are highly significant. We furnished 41.8 per cent of Japan's requirements in this bracket in 1933, 30.3 per cent in 1934, and but 16.9 per cent in 1935. Meanwhile, from the East Indies—largely from Dutch and British Borneo—while her imports of crude from this source varied in the three years under discussion only from 14.5 per cent to 16.8 per cent, the percentage of refined products rose from 48.2 per cent in 1933 to 55.2 per cent in 1934 and to 66.1 per cent in 1935.

It is simple enough, given these figures and the further facts that there are in Dutch and British Borneo enormous oil fields as yet untapped, and that—as regards Dutch Borneo, at any rate—much of the oil lands is in the possession of native rajahs who are none too well controlled by the Dutch, to figure out just where the Japanese will get their essential supplies of oil if the American export is cut off.

Add to that the fact that many of the Dutch islands are a source of rubber supply, and the future of the embargo policy becomes even clearer. Dutch India supplies to-day a very high percentage of Japan's rubber imports, being second in this respect only to the Straits Settlements.

What course will the Japanese Government take if an embargo cuts off American crude-oil shipments, or, worse, if some form of international action, perhaps participated in by the other signatories of the Nine-Power Treaty—including Britain and the Netherlands

—is taken to "quarantine" her as an aggressor? Will such a quarantine, as Senator Pittman has assured us, bring Japan to her knees in thirty days?

Or may we assume that a better forecast of Japanese policy may be found in the speech of Admiral Sankichi Takahashi—then commander-in-chief of the Combined Fleet—in 1936:

"Japan's economic advance must be directed southward, with either Formosa or the South China Sea Island Mandates as a foothold. In this case, the cruising radius of the Japanese Navy must be expanded suddenly as far as New Guinea, Borneo and Celebes." —As quoted in *Japan over Asia*, by W. H. Chamberlin.

Necessity Knows No Law

We must not for one moment assume that Japan's policy in such an extremity will be guided by any other considerations than those of military expediency. And military expediency will dictate that Japan must make herself secure, in so far as security may be achieved, while yet there is time, while yet she is the supreme sea power in the Western Pacific. To picture the military and naval chiefs who rule the empire as sitting with their hands folded in the laps of their kimonos and awaiting the moment when the last drop of gas shall have filtered through the carburetor of the last tank, when the last airplane shall have come fluttering to earth, and the last destroyer lies rolling helplessly on the long Pacific swell with empty tanks, is to blind oneself to everything that we know of the Japanese character, to every lesson to be drawn from their history.

Not while an ample supply of oil is situated on their very doorstep, and in a region, too, which can supply them with rubber and other requisites—nickel has been found in Celebes—will the leaders of Japan, who have staked everything on the present war in China, give in to western pressure. Consider the devastating loss of "face" if they did yield. One vast echoing yell of Oriental laughter would sweep across Asia from the Amur to the Irrawaddy, and with it would vanish every vestige of Japanese prestige and power on the mainland, all her dreams of empire.

No, the military leaders of Japan know the stakes for which they play, the risks they run; those risks have been well calculated, and the plans are ready to meet any move that may be made against them. Just as the army is prepared to deal with a Soviet advance across the Amur or through Outer Mongolia, so the Navy has long been prepared for the sudden thrust to the southward of which Admiral Takahashi so frankly speaks. And there is a further question of "face" involved—the Imperial navy has had but little glory out of this Chinese war so far, and an intense rivalry exists between army and navy, between Choshu and Satsuma. The navy will not only act, it will be found eager to find an excuse for acting. Remember that in Japan the navy is quite as independent of political control as the army.

The Powder Train

In order that the Borneo oil fields may meet all Japan's requirements, in order that Borneo and Celebes rubber may fill the gap left by Malayan imports, there must be swift, scientific, intensive exploitation by Japanese engineers and experts. That means control—physical control, backed by force sufficient to prevent interference or legal quibbling.

There will be no hesitation. The first overt move, whether made by this country or by a group of powers, will be the signal for Japan to act. Her leaders cannot afford to wait and see whether other powers will join us, cannot afford to give time for American or British naval power to move toward the scene of action.

What, then, will be the result of an American or international embargo on exports to Japan? Almost inevitably, the seizure by Japan of Dutch Borneo and, perhaps, of adjacent islands such as Celebes. And, of course, the occupation of the Philippines as giving strategical access to Borneo and as providing the necessary link in the chain of insular positions extending from the Japanese main islands southward by way of the Ryukyus and Formosa to the Philippines and the Dutch archipelago.

What will the situation then confronting the people of the United States be? The territory of a small friendly power will have been seized, and, it will be said, through our fault; our own quasi-Dominion of the Philippines will be in Japanese hands, save,

probably, for the remnants of the American and Philippine Scout garrison holding the fortress of Corregidor; one can but conjecture what will have been the fate of our Marines at Peiping and Shanghai, of our Fifteenth Infantry at Tientsin, of our defenseless outpost at Guam, of our weak and hopelessly outnumbered Asiatic Fleet.

We shall be inevitably committed to the expulsion of the Japanese from the raped islands, and that expulsion can be achieved only by force, at the cost of a long and bloody war.

Just how long and how bloody cannot, of course, be foretold.

But it may be well to consider that it is more than 5,000 miles from Pearl Harbor—our farthest western base—to Manila, and that the operating radius of a fleet is but half of that, being limited by the cruising range of the destroyers. Hence, to begin with, a base must be obtained somewhere in the Japanese mandate islands as a half-way station—say at Truk or Ponape, or by retaking Guam. This means not only naval operations but the dispatch of an expeditionary force to take and hold the base, for guns and ammunition, of planes, of thousands of tons of supplies of all sorts; and all this must be transported through waters infested by long-range Japanese submarines and guarded by innumerable Japanese islands which form potential submarine and aircraft bases.

When this has been accomplished—and not until it has—the fleet can operate in Philippine waters. By that time the Japanese should have consolidated their position in Borneo and the Philippines; and their ejection thence means again, not only naval operations but a much larger and more elaborately equipped expeditionary force than before—probably not less than a quarter of a million men, with ample replacements to meet the drain of battle casualties and tropic disease.

In the end, doubtless, we should win. Our superior resources ought to be too much for Japan. But Japan's advantages of position and interior lines would be such as to make the victory cost us very dearly indeed.

Enough has been said to make clear that the price of interfering in a war that is no concern of ours may well, in the end, be war for this country, too: a war fought on the other side of the Pacific Ocean, under conditions of almost incredible difficulty, and for what?

What possible gain could we derive from such a victory that would be worth the price? The loss of the best of our youth, the crushing load of debt, the domestic troubles, perhaps extending even to the destruction of our institutions—what would compensate us for all these?

The Road to War

Perhaps we must face the loss of our China trade; there are markets closer home which ought to compensate us. Prestige of the white man with the yellow races? It is gone forever, and we cannot snatch it back. International morality and collective security? Ethiopia and China placed their faith in those empty phrases, and where are they to-day?

We pride ourselves on being a practical people, though in our view of international relations we are anything but that. It is time to face the facts—before it is too late, before the lure of a new crusade has led us, step by step, into the abyss of another war to make the world safe for democracy.

It is upon the road to such a war that we take the first step when we talk of boycott, when we dream of embargoes, when we visualize international control of aggressors by means of economic sanctions.

Let us not deceive ourselves. Any step taken to deprive a nation at war of essential supplies is an act of war against that nation. It makes no difference by what pretty name we call it: what matters is what the other fellow calls it. When labor unions vote boycotts on Japanese goods, they are voting for war. When Dr. Raymond Leslie Buell, of the Foreign Policy Association, figures out an ingenious plan for using the provisions of the Neutrality Act to embargo exports to Japan, he is planning for war. When a great New York newspaper publishes and advertises—a map showing how Japan could be blockaded in the Pacific without danger of hostilities, it is blinding itself and its readers to the true implications of its advice.

Embargo and boycott are tantamount to blockade. They are blockade. And blockade means war, and will be countered by war.

Central China Reconstruction

By MASAHARU YOSHIDA

(Mr. Yoshida has been residing in Shanghai for 15 years and has until recently been the manager of the Shanghai branch of the Mitsubishi Bank. He is now the president of the Japanese Chamber of Commerce in Shanghai and is adviser to the Mitsubishi Bank. He is considered one of the foremost authorities on China's financial and economic problems and is credited with doing much toward the reconstruction of Shanghai).

* * *

By dint of ceaseless activities lasting for six months, the Imperial Japanese forces have achieved remarkable results, having captured the enemy capital of Nanking, bringing the Chiang Kai-shek government to its virtual downfall.

Nevertheless, Japan still has a long and thorny path to travel and our brave and gallant officers and men are continuing their activities on land, water, and in the air throughout China.

We Japanese at this moment would do well to reflect and seriously consider one or two things.

First, the Japanese must see that the factors that have brought the Sino-Japanese conflict to the present intensity are removed, in consideration of the tireless efforts of the Japanese forces to chastise the erring war lords, in order to establish lasting peace in the Far East.

Second, those of us at home who have not taken part in the hostilities, owe it to ourselves to embark on the political, economic, and cultural reconstruction of China with a view to stabilizing the Far East. Then and then only can we repay at least part of our enormous indebtedness to our fallen warriors.

Of course, the reconstruction and stability manœuvres in China vary greatly according to category and geography and even a summary discussion of them all would require volumes. For convenience's sake, I shall confine my efforts toward asking the government and people of Japan to consider the economic reconstruction of Central China.

Overshadowed by North China

Heretofore altogether too little attention has been paid by the people of Japan to the potentiality of Central China. There may have been some political and diplomatic reasons for this. By far the greatest reason must have been the assumption that in North China there are greater resources that could be exploited all at once.

Of course, we are glad to note that a new regime has been proclaimed in North China and we express satisfaction and gratitude to our compatriots for their efforts toward economic reconstruction in that region. The attaching of great importance to North China, however, does not justify the slighting of Central China.

We need not concern ourselves here about whatever oversight our countrymen may have committed in the past in regard to Central China's potentiality. It will have to be admitted that the Yangtze valley has now come to assume enormous importance from the economic, political, and military standpoint.

The region's importance is, in fact, so great that I venture to say that unless the Yangtze valley is taken into serious consideration in Japan's manœuvres for solving permanently the China problems, the present China campaign is liable to lose much of its *raison d'être*, in which case tens of thousands of martyred warriors will have died in vain.

Reasons for Past Neglect

The reasons the businessmen of Japan have paid less attention to Central and South China may be found in the following beliefs:

(1) Central and South China are the center of Western powers' interests.

(2) There are few easily exploited resources in those regions.

(3) The Chinese people in those regions are less docile and manageable than the northern Chinese and therefore they are more susceptible to anti-Japanism.

I am inclined to believe that the majority of our compatriots are unable to get rid of these impressions and have so far hesitated to take the initiative in Central and South China, which fact has undoubtedly contributed to intensify the chaos in the past.

In regard to the first belief, concerning the existence of foreign powers' tangled interests, I should imagine that the very presence of other powers' vested rights in those regions should encourage Japan. If we had interests in the Yangtze valley or in Central China that would outclass those of other powers, anti-Japanese manœuvres of such intensity would not have been launched and the present China Emergency would not have come about.

I need scarcely say that we have no reason to fear Western powers' interests and rights in those regions. Nor do we elect to exclude them.

We are always ready to respect others' vested rights and interests. All we ask is that we be given a fair chance to compete with them on equal terms.

What we object to is this: The Western powers in their eagerness to maintain their advantage and to hold in check the Japanese advance, have been in the habit of extending unreasonable aid to China. We must see that this ceases, if we expect to place the Sino-Japanese amity and Far Eastern peace on a permanent basis.

First of all I would suggest that Japan strengthen her economic foothold in the Yangtze valley to a level at least equal to that of Britain, so as to make the Chinese public and resident foreigners feel that it would be to their advantage to co-operate with Japan there as well as in other parts of China.

As long as Japan does not have great economic interests in the Yangtze valley to work on, which would enable her to wield influence with the Chinese masses, the Sino-Japanese controversy in that region will continue for some time, I fear. It is high time that the Japanese government and businessmen seriously considered the economic reconstruction of Central China.

That is the logical way, and the only one for that matter, to solve the problems of the perpetual peace of the Far East and of readjusting Sino-Japanese relations. It would be unworthy of the red-blooded Japanese to seek that which looks easy and to shirk that which seems difficult and vainly to envy others who have something to work on.

Concerning Potential Resources

Regarding the second stumbling block making the Japanese hesitate to make economic advance in Central China, there apparently do not seem to be such potential resources as could be acquired and utilized with comparative ease.

In North China, such factors as iron and coal, which are easy targets for prospective investors, are abundant, whereas, in Central China, conditions are different. That is what has made Japanese financiers and industrialists hesitate to take the initiative.

Of course we are ready to make allowances for the comparative stability of the political situation in North China, which has gone a long way toward inducing prospective investors to take definite steps in that region. From now on, however, Japan cannot afford to have anti-Japanism creep into Central China, where she has been forced to conduct extensive military operations at enormous cost. The region should be made absolutely safe so that perfect Sino-Japanese economic collaboration can be obtained.

The political stability and economic liberty for Japan in Central China must be established and maintained at all costs and against all hazards. Then there would be no longer any reason for Japan's hesitating to make an economic advance in Central China, the moment the political stability and freedom of economic activities shall have been secured by the tireless efforts of the Imperial forces.

I base my contention on the fact that equitable economic assets in Central China are just as bountiful if not more so than they are in North China. Moreover, industrial facilities in Central China are incomparably better developed than in the north.

The economic value of Central China differs slightly from that of Manchoukuo and North China, due to such reason as are mentioned here, namely (1) the region is more densely populated; (2) it has a wider area of hinterland as background; (3) the soil is much more fertile; and (4) it has a more extensive network of waterways.

As evidence of the economic value of Central China, it has been frequently said:

"As long as Kiangsu and Chekiang provinces prosper, there is no danger of the neighboring 10 provinces starving."

Astounded by Fertility

I have heard on good authority that some farmers among our first line troops, upon examining a lump of soil near Soochow, were astounded by its fertility. Iron, coal, and gold are not necessarily the sole assets. Cotton, rice, and above all the purchasing power of the public of Central China are just as valuable assets as iron and coal in the north. Is this fact not worth considering seriously?

What people should take into serious account upon making an economic advance anywhere in China are industrial and financial facilities and their functioning. The prospective financiers and industrialists should remove the pre-conception that China is invariably in a colonial aspect.

In point of truth, Central China has seen to a certain extent the development of capitalism, and agricultural, industrial, and commercial activities have reached some sort of maturity. This means that the region is worth all the more making effort for economic advance.

Another reason the Japanese hesitate to make an economic advance in Central China is the generalized impression that the inhabitants in the region south of the Yangtze river are more virulent and less docile than northerners, believing they are more responsible for anti-Japanism than their cousins in other parts of the country.

I do not deny that the Central Chinese are of more truculent temperament and open to resistance. At the same time, they are more intellectual and possess superior technical skill than their northern cousins. In this connection, it should be remembered that most of those in the ruling classes in the north, including those of the East Hopei autonomous state and the provisional government of China recently proclaimed at Peking, are southerners.

Take Counsel with Southerners

Not that the southerners are easier to handle, but the northerners in modern times have been somewhat lacking in fighting spirit. It would be unwise and disadvantageous to avoid the southern Chinese in dealing with the Chinese in the future. Instead, it would be well to take counsel with the southerners who occupy positions of trust and responsibility throughout China.

With respect to the anti-Japanese wave in Central and South China, I do not wonder the general impression prevailing in Japan that, due to extensive anti-Japanese education which the Kuomintang government conducted for 10 years or so and considering the havoc wrought in the region by warfare, the southern Chinese entertain implacable hostility toward Japan and the Japanese.

Such a view, however, does not describe the actual conditions. The Chinese are a race that values personal safety and security of property above everything else.

As long as peace and order shall have been re-established in the Yangtze valley, where Japanese influence and prestige shall have been enhanced, I would not be a bit surprised to see the erstwhile anti-Japanese agitation vanish and the Chinese refugees return swiftly to their homes. The sheer pessimistic outlook carries no weight whatever.

The intense anti-Japanese agitation in China in the last several years has all been government-planned and government-operated. Violent as the agitation may have seemed, it was the kind that would vanish the moment the government instigation was removed.

No people on earth are more keenly concerned over the stability of their livelihood and personal safety than China's 400 million inhabitants. It is easy to see that to embark on an extensive anti-Japanese movement from political considerations is not their innate desire. The degree of their education matters little in that connection.

I know there are not a few observers who point out the strengthened nationalistic consciousness as a reason for anti-Japanism.

The so-called nationalist thought trend and movements in modern China are what the Chiang Kai-shek regime utilized as a means of unifying the country in conjunction with the military unity and increasing anti-Japanism.

Masses are Like Sand

Sun Yat-sen, father of the Chinese revolution, somewhere puts it:

"The Chinese masses are and have for ages been like sand. If you apply pressure and pour water into them from above or sideways they will solidify themselves like cement. But the minute you remove the pressure they will be the same old sand once more."

Now that the Kuomintang has lost its grip on the masses, and inasmuch as Japan's China policy under altered conditions shows indications of winning the confidence and support of the Chinese public, I do not see why anti-Japanism should not vanish before long.

In any event, I consider the fate of anti-Japanism will be determined by the degree, nature, and caliber of Japan's new China policy. Certainly China's anti-Japanism is not nearly as enduring intrinsically as some of our business quarters fear it is.

I have thus far advocated the necessity of Japan's showing positive zeal for an economic advance in Central China and have demonstrated that pessimism is absolutely unjustified.

Let us consider the practical steps for carrying out the economic advance.

- (1) Economic facilities pertaining to public utilities or basic institutions should preferably be operated by the state or by organizations of a national nature.
- (2) In regard to commercial, industrial, and agricultural enterprises, Japan's individual businessmen should investigate and make an advance.

As pre-requisites, I would suggest that three items should be taken into account, namely, (1) stability of the Shanghai area, (2) raising funds for an economic advance, (3) the basic control of economy, including Chinese and foreigners in that region. I have no time to go into details regarding the third item here.

For Fair-dealing Regime

In regard to the stability of and peace maintenance in the Yangtze valley, the most logical thing is the creation of a new pro-Japanese and fair-dealing regime. Supposing such a regime does not appear and Chiang and his associates continue their protracted resistance against us, Japan should take a self-initiated step toward establishing the political and economic stability of Kiangsu and Chekiang provinces.

Strictly speaking, Japan should already have commenced such manoeuvres. If a fair-dealing regime inclined to be friendly toward Japan appears on the horizon soon, well and good. Then Japan may co-operate with it or, better still, leave the matter in its hands.

With reference to finding funds for the economic advance and reconstruction in Central China, the Japanese government would do well to give the matter serious consideration, second only to military expenditures in importance, inasmuch as the true mission of the present armed conflict lies in readjusting the Sino-Japanese relations and establishing permanent peace of the Far East.

I would therefore suggest that the government give special consideration to the question of the funds legitimately needed for reconstruction of state importance in Central China. At least, I would attach as great importance to the Central China reconstruction fund as to that which was spent for the economic construction of Manchoukuo.

With respect to the third question of controlling economy, the matter requires careful study and opinion should not be advanced in a haphazard manner. The so-called equal opportunity principle advocated by Occidentals deserves consideration.

The law-abiding Chinese should be encouraged to take the initiative in communicating and co-operating with the Japanese on the principle of live and let live.

Must Avoid Future Friction

At the same time, due thought should be exercised in regard to the possible friction the Japanese economic advance may create

(Continued on page 108)

China's Needs for Proper Development*

By J. A. L. WADDELL, Consulting Engineer; Honorary Member of the Association of Chinese and American Engineers

(The author of this paper is the oldest engineer connected with this Association and, of course, senior to all the active members. Though he has not been in China since the end of 1929 and has not noted at close hand all the changes that have occurred, he has kept in touch with China and has long been one of her most sincere friends. This paper was prepared at the invitation of the Editor. A man of Dr. Waddell's age and experience should speak as frankly as he likes, no matter though his opinions may be at variance with a number of members. The Association welcomes words of wisdom from its elders and the sages.—EDITOR).

THE future successful development of China is essentially the task of the engineering profession, backed, of course, by the judgment and direction of able statesmen. But why should not the great majority of such statesmen be themselves engineers? If such were the case, the outcome of their joint labors would be greatly improved and augmented.

That the countries of the Orient can best be developed by engineers has been clearly demonstrated in the last half century by Japan, not only in that country itself but also in its dependencies, Korea and South Manchuria.

What Japanese engineers have done Chinese engineers will be able to accomplish, if given a fair chance; but of late years they have been heavily handicapped by lack of funds for construction, a vacillating policy of government, threats of foreign wars, and frequent internal uprisings. My experience in China with Chinese engineers has proved them, as a rule, to be able men, especially those who have studied in the U.S.A., and among them notably those who have had some office and field experience in that country. The chief deficiency of Chinese engineers, as a class, is lack of such essential experience. Many of them are fairly well posted on the "why and wherefore," but few of them are properly conversant with the "how and do." Well-trained engineers in China are so few in number that, were any large amount of rush building ever called for there, the supply of native engineers would soon be found entirely inadequate. Such, at least, was the case when I was there in 1929; and, as far as I know, this condition is no better to-day than it was then. Early that year, in view of a certain approved policy of extensive and immediate railway construction, I advised the Government to give in several of its technical schools to the senior and junior classes an intensive special training in railway engineering. This policy was on the verge of adoption when the big constructive program was abandoned by reason of lack of money, owing to large expenditures thereof that were being made in suppressing rebel uprisings.

Preliminary Necessities

Before important constructions in China can even be seriously considered, several fundamental requirements must be consummated:

(1) There must be a permanent peace established with Japan. It is quite feasible to arrive at a peace agreement that is honorable to both sides; but it might be necessary to arrange the details thereof through a board or jury of eminent foreign statesmen selected by both parties from some of the great nations of the world.

(2) All existing rebellions must be overcome, and the instigators and leaders thereof must be severely punished. I fear that in prominent cases, the death penalty is the only punishment that will prove effective.

(3) Arrangements must be made for drastically putting down and ruthlessly stamping out, within a very few days, every future incipient uprising. To accomplish this would require a large and well-manned fleet of bombing and fighting planes.

(4) Negotiations should be perfected for borrowing large sums of money abroad, especially in the United States, to be devoted exclusively to adequately approved construction projects.

(5) A comprehensive method should be evolved and established for honestly operating all large and important enterprises and for collecting the receipts therefrom. There has been altogether too much petty pilfering and misappropriation of moneys in China,

especially in the last decade or two; and it is essential that this dishonesty be stopped *in toto* without delay.

(6) Before any extensive construction is undertaken, and before its financing is even considered, there should be prepared, in full detail, a feasible layout of general development of the country in all lines; and the approximate times of starting and of completing each such piece of work should be indicated therein. The preparation of this layout should be done mainly by a standing board of Chinese engineers, aided by foreign technical men of established reputation in the various specialties involved. American engineers who have had wide experience in China would be the best men for this purpose, because China's present needs in development resemble America's like needs in the past more closely than do those of any other country in the world. There are still living and available for such service a number of prominent American engineers of proven devotion to China's true interests.

In respect to the first necessity, I might state that for the last sixteen years I have been openly expressing the opinion that the interests of China and Japan in the distant future are going to be closely intertwined. It is the logical thing for two peoples of like origin and such close neighbors to pull together for mutual benefit.

In respect to the second and third necessities, it must be evident to every thinking person that no country can thrive that is divided against itself. A spirit of national loyalty in China has been conspicuous by its absence. An average Chinese citizen is loyal to his family and to his home town; but he cares very little about his country as a nation. This evil can best be corrected through education in the common schools of the country, but that will take at least two generations. Meanwhile, force will have to be employed to keep the people at least law-abiding, if not patriotic.

In re the fourth and fifth necessities, it is my opinion that, if China were really at peace, both externally and internally, and if she could by her governmental actions recover her old reputation for strict business honesty, which she has lost of late years, she would have no serious difficulty in borrowing very large amounts of money from America, which country is now the world's leading banker, on account of its vast cash holdings. It requires only a satisfactory assurance of integrity and honest treatment to induce American capitalists to lend their accumulated wealth at reasonable rates of interest. There are a few indebtednesses by China to certain financial institutions and individuals in the United States of America that would have to be settled satisfactorily before the American people would believe in the financial-honesty reform of the Chinese nation.

It is more than probable that there will be some strings attached to future American loans to China, in order to ensure the proper, agreed-upon expenditure of the money loaned and the honest operation of the completed project, and in order to make certain of due payment of both principal and interest. This has been customary of late years; but it might not be insisted upon in that dim and distant future when China shall have recovered her old, established reputation for integrity and square dealing.

As for the sixth and last-mentioned necessity, I might remark that the failure of the Chinese Government to have a complete, logical, and enduring policy of national development has militated seriously against the attainment of satisfactory national progress. The establishing of such a layout of policy will certainly prove to be no light task, even for the best brains of China aided by the most competent available experts from abroad.

But supposing that all of these six necessities have been duly met, what then should be the best method of procedure?

This question I shall endeavor to answer to the best of my knowledge and belief, based upon personal experience that, unfortunately, is all of eight years old, supplemented by what I have read in the daily press and the small amount of information I have

*Reprinted from the *Journal of the Association of Chinese and American Engineers*.

accumulated by correspondence since my last visit to China. I do know that certain advances have been effected, such as the building of a few highways; but my impression is that no great amount of useful work (in proportion to the immense extent and population of the country) has been done since my departure—in any case very little compared with the amount that ought to have been accomplished, in view of China's pressing needs.

The term "communications" is intended to cover telegraph, telephone, wireless, and radio. In 1929 the first three of these methods were in operation, but were working crudely; and the fourth was in an experimental stage. To what extent they are now developed I am not sure; but I surmise that they are still far from perfection. If such be the case, they should be brought up to date with the least possible delay, so that business throughout the Republic shall not be handicapped by their inefficiency.

Transportation

Under the heading "transportation" are included railroads, highways, waterways, and aviation. The best possible division of traffic between these four means of transportation is an economic problem of the first magnitude; and it should be finally solved, after a thorough study by a mixed commission of Chinese and American transportation specialists of the highest order, before the work of construction is started. The latest tendency to-day in America is to use highways as the main feeders of trunk-line railroads; but, in my opinion, it would be a mistake to carry that policy too far in China, because some branch railroad lines are really needed, especially to reach cities of large population that are at quite a distance from the nearest trunk line.

The apportionment of traffic to the waterways is not a difficult problem, because water transportation is the cheapest of all methods, although also the slowest; hence perishable freight and passenger traffic should not be routed in that way, excepting for short distances. The great value of speed in transportation is something that the Chinese nation has yet to learn and appreciate—at least it was so when I was last in the country.

Nor is the allotment of traffic to aviation a difficult matter to settle, because aerial transportation is always so expensive that its adoption should, for many years to come, be confined to mail, light express, and people who are in such a great hurry that they are willing to pay any reasonable amount for the privilege of being carried in the shortest possible time to their destination. Combinations of very fast railway trains and aerial transportation are now being established in America, and some such arrangement should be studied for future transportation in China.

Railways

The railways of China, covering, all told, only some 7,000 miles of line, are fortunately of standard gage; but they are built to carry comparatively short trains composed of lightly loaded cars, drawn by light locomotives. This combination is fitted for small-package freight, but not for freight in bulk, such as ores, coal or grain; consequently, the rates on the latter type are much too high, in spite of the cheap labor of the Orient. It would be no great trick to widen the embankments a little, use more ballast, and employ bigger ties and heavier rails; but this would do no good unless all the bridges were strengthened. However, on this matter more anon.

Chinese railway navvies generally keep the track in fair order by cutting weeds, ballasting, and repairing banks, but the ties are often left in too long for safe operation. The item of drainage is fairly well looked after; nevertheless, I have many times noticed the side ditches full of water in places where a little extra digging would drain them properly. Railroad drainage in China is inexpensive, and the results of its perfectioning would be well worth while.

If China's railroads were built and operated in first-class American style, the cost of their operation would be much reduced. In my opinion, the Peiping-Hankow Railway, either now or in the very near future, could economically be double-tracked, and some day also the continuation of that line to Canton.

The building of new railroads in China has a decided advantage over the construction of the pioneer railroads in America, because in the former case the population is always ready and waiting for the railroad, which condition enables the line to pay dividends from the day it is opened, while in the latter case it was generally necessary to start from a rather lightly populated terminus and

build out into the wilderness, trusting to Providence and good luck to develop population along the right of way later on. This feature should militate favorably for the financing of Chinese railways both at home and abroad.

Highways

The wonderful expansion in America in highway building during the last decade or two should afford Chinese engineers a valuable object lesson in the economics of transportation; nevertheless American practice in this specialty should not be blindly followed in China, where the conditions of life are so different. In view of America's great wealth, it pays to build first-class highways in most localities; because, even in out-of-the-way districts, there is no telling when a modern heavy truck with an overload will come along—a loading that would crack and soon ruin any cheap, inferior pavement. In China it would be practicable to prevent heavy trucks from passing over the "feeder" highways, but in America to do that would be exceedingly difficult.

The main highways should be paved, preferably with reinforced concrete; the feeder highways should be macadamized for light motor vehicles; and farm connections might well be simply earth roads. Such an arrangement would be economical in China, notwithstanding the fact that it would involve much shifting of loads; but labor there is so plentiful and so inexpensive that its employment in freight shifting would be in the line of true economy.

Waterways

The inland waterways of China have been utilized during unnumbered centuries for the carrying of passengers and freight in light craft, but never to their ultimate capacity, because the boats have been small and have been operated mainly by man power, although even in the dim past, sails were used when the wind was favorable, and to-day there are some power-craft plying the network of rivers and canals that crisscross the great plains of the interior. It is my opinion that by a thorough study of these waterways on a grand scale there could be evolved a satisfactory, economical system of slow-freight transportation by power boats that would aid materially in the development of China.

I recognize that such a system of navigation would have to contend occasionally with serious difficulties, such as the clogging of channels in the silt-bearing streams and the loss of channel markers during the great floods that sometimes endure for several months; but such troubles are far from being insurmountable. Possibly such a survey study as I have indicated has been made in years long past, and the records thereof may even be extant. It seems to me that this suggested improvement of internal navigation is worthy of at least serious consideration.

Aviation

About the first thing I did on my arrival in Shanghai in January, 1929, was to impress upon the Minister of Railways the necessity of establishing without delay an extensive system of aviation for both civil and military purposes; and I recommended that my old friend, Captain Carl H. Dolan, who for some three years served the Peking Government as head of the Aviation Bureau, be cabled to come and install the new system. The first portion of my recommendation was accepted and acted upon at once; but someone other than Dolan was selected to head the movement. It was not long before the Minister himself was flying between Shanghai and Nanking. It was my desire that landing fields be established in all parts of the country, and that all important letters be sent by plane. However, as aviation was not in the direct line of my work, I paid no further attention to it, but contented myself with the thought that I had given flying in China an impetus, and let it go at that.

Since the preceding was written, Captain Dolan and I have been in conference concerning the subject of air and other transportation for China's immediate future; and, after considerable discussion, we have arrived at the following conclusions:

In a country like China, the ideal method—as well as the greatest and quickest aid in approaching the transportation problem—would be the immediate installation of air trunk-lines between the capitals of all the provinces with multiengine planes, whose factor of safety would warrant their crossing mountains

and bad country without the aid of landing fields every 50 miles, as is the case in this country. These trunk-lines could handle mail and passengers, as well as fast express. Their operating costs to-day are so well known that, in the United States of America, passenger fares of 5 cts. a mile for this *de luxe* travel are well in keeping, when one considers the fact that the Interstate Commerce Commission had to force the railroad and Pullman fares down to 3½ cts. a mile! These trunk air lines in China should be fed by bus lines through adjacent territory—the main trunk railroads following the heaviest travel routes and branching out to all of the provincial capitals. The airways should then extend beyond such main trunk-lines and work in conjunction with them so as to tie the whole into a homogeneous unit of transportation.

If such a system as outlined above had already been in existence when the present hostilities broke out, it would have been almost impossible for an invader to cripple transportation by the blowing up of a bridge or a trunk-line railroad or a highway; and the communication system that operates in conjunction with an air line would be of untold value to the Chinese. Furthermore, such a system would unify China by the fact that the controlling forces of the proposed network could easily move troops, guns, and military airships along these airways from one end of China to the other, as the United States Army moves from the Atlantic seaboard to the Pacific to-day in fifteen hours—far beyond the concept of mobility of the commanding officers of either the Army or the Navy. There is one paramount asset that aviation has in a country such as China in excess over any other mode of transportation—principally railroad. Once a railroad is built, its largest investment—namely, the roadbed—must forever stay on and in the locality in which it is constructed, with its numerous expensive tunnels, gradings, bridges, etc., whereas an airway's principal and practically total cost is in its rolling stock, which can be moved out of an area if and when a trade route warrants it, without any loss to itself. In pioneering in new country this item is of the utmost importance.

Bridges

A large portion of my time in China during 1929 was devoted to bridgework, mainly the examination and reporting upon existing structures on four trunk-lines of railway, and figuring on three large bridges at Wu-han over the Han and Yangtze Rivers, another over the Yellow River on the Kin-Han Railway line, and some smaller new structures elsewhere. I strongly advocated building a bridge-shop at Hankow; and my firm was retained to prepare plans and specifications therefor, in order to call for bids from Belgium on its construction and equipment, because the money for its consummation was to come out of the Belgian portion of the returned Boxer Indemnity Fund. Unfortunately, the said money was spent for something else—mostly putting down rebellions, I imagine.

To what extent my recommendations concerning the strengthening of old bridges have been followed I do not know. They were, in the main, doubling up similar existing spans, i.e., making two bridges into one, and building full-strength new structures to fill the gaps thus left.

In re the designing of new structures, I now strongly recommend the Government to adopt for railway bridges the latest specifications of the American Railway Engineering Association, and for highway bridges those of the American Association of State Highway Officials. My firm has lately adopted both of these for our office practice instead of those given in my book, *Bridge Engineering* (now 21 years old); because live loads, impacts, and intensities working stresses have lately been changed, and because silicon steel has come into vogue since that treatise was written.

While that new alloy has not yet replaced in America carbon steel for plate-girder-bridge construction, I believe that it could do so economically to-day in China, on account of the saving in ocean freights, especially if the said plate-girder shopwork were done in China—as it certainly should be, for several good and important reasons.

In 1929 I made orally (possibly also in writing) an important suggestion to the Minister of Railways, viz., that there be prepared by competent American bridge specialists standard *working drawings* for the superstructures of both railway and highway square-crossing bridges, varying in length by gradually increasing augmentation from very short spans to those as long as are likely to be called for, thus largely saving both time and money. It was suggested that it would be better to have such work performed in China by Chinese engineers, in view of the excellent training it would afford them.

To this I replied that the idea would be a good one, provided the said Chinese engineers operate under the direction and control of a few highly experienced American computers and shop-draftsmen, who would be held responsible for the absolute correctness of all computations and drawings. I think that this suggestion has not been adopted. If that is so, now is the proper time to prepare such standards, because the science of bridge design and the art of metal manufacture have lately in America been brought to a high state of perfection; and no important innovations therein are now imminent.

This policy of having standard working drawings ready for all probable calls for superstructures has been in force during several decades in Cuba, but for highway bridges only. The preparation of the designs and the working drawings was entrusted to me, at first for old-fashioned wagon-bridges, and later for structures to carry modern live loads from heavy motor vehicles. The operation of this policy has been found exceedingly satisfactory by the Cuban Government.

River Conservancy

The protection of China's most densely populated areas against the overflow of her great rivers, especially the Yellow and the Yangtze, is one of the most important and pressing engineering matters for consideration by the Government. No thoroughly exhaustive study of the problem has yet been made, in spite of its extreme importance. There is one man in China who knows more about the subject than does anyone else in the world—Major O. J. Todd, an American engineer of high standing, who has faithfully and fearlessly devoted nearly two decades of his professional career to China's welfare, often facing the probability of death from so doing. In my opinion, he should be placed at the head of a Commission, composed of both Chinese and American engineers, to study the various special problems on the ground and the present state of the science of river engineering abroad, especially in America, where stupendous problems in this line of technics are now being studied and solved. Sufficient time should be allowed the Committee to complete its study and make a report outlining in detail its recommendations concerning what should be done, how to do it, and the probable cost of the entire work for each special case, as well as for the whole undertaking.

It might be better, perhaps, to single out the Yellow River as the most pressing problem and rush that through into action before the completion of the final report, because that stream with its present more or less ineffective control is a constant menace to the lives and properties of millions of people. China should awake to a recognition of the gravity of this menace and arrange to provide, with the least possible delay, adequate means for its effective subjugation.

With proper governmental guarantees of repayment of both principal and interest, it would, I feel sure, be feasible to raise in the United States of America all the money required for this special case—and possibly for other important like cases later on.

Industries

As a matter of economic policy it should be evident to every clear thinking mind that China ought to produce at home, on both small and large scales, a great many things that are now imported to supply the necessities (and even some of the luxuries) of her numerous population—or, in a few instances, also for export.

I have already mentioned the crying need for one or more bridgeshops; and I would state most emphatically that not a single barrel of cement should be imported from foreign countries. Sufficient raw materials for Portland cement are to be found in various parts of the Republic; and these should be assembled at various suitable centers where a supply of either fuel or electric power are available, and from which places the product can be distributed economically. There were in China in 1929 a few plants for the manufacture of Portland cement, but the greed of the manufacturers induced them to sell their product, with large profit, at only a cent or two per barrel below the cost of the imported article, which then was by no means low. Such manufacturers were thus so unpatriotic that they deserved to have their mills taken over by the Government and operated on an economic basis, in order that cement might be sold to Chinese constructors and contractors at just a little above the actual total cost delivered at site. It is undoubtedly true that governmental operation in no country is very economical; but that is a fault which is feasible, though

difficult, to correct; hence it would be better to let the individual or the companies, as the case might be, handle the manufacture and sale, but under the close, rigid supervision of strictly honest governmental employees.

There are many small electrical appliances that could be cheaply and advantageously manufactured by Chinese workmen, also many chemical products—in fact, eventually China could make herself almost entirely independent of the rest of the world in all lines of industrial production. This is because Chinese labor is cheap, fairly efficient to-day, capable of being trained to a high state of efficiency, and naturally steady and law-abiding (when left uncorrupted). Certainly there should be a splendid future for manufacturing industries throughout the Chinese Republic!

With proper solicitation and guarantees, such outstanding manufacturers of trucks and other motor vehicles as Ford and General Motors might be induced to establish in China, entirely at their own expense, a number of branch manufactories of their vehicles, thus providing thousands of Chinese workmen with comparatively well-paid employment.

Water Supply

The entire area of China indubitably needs adequate supplies of pure drinking water, because the people are constantly using water, which inevitably must kill some of them. Possibly the Chinese have become, to a certain degree, immune to some of the poisons in their drinking water, or possibly their tea-drinking habit, which necessitates boiling of the water, helps them out a bit; nevertheless, it cannot be denied that a vast number of the population is constantly drinking water that is unfit for human consumption.

For the large cities and towns, modern systems of water supply with effective purification works are needed; and for all smaller communities, there should be provided, wherever practicable, deep-driven wells that reach into a supply of untainted artesian water. Where such pure water cannot be found, some cheap but effective method of purification should be evolved. All such work as this is the function of the engineering profession; and it is my firm conviction that Chinese engineers will eventually be found capable of solving this important problem.

Sanitation

Sanitation, like national loyalty, in China is conspicuous by its absence; and a large portion of the population lives in filth and squalor, as can readily be observed in most places by both one's eyes and one's nose. What should be done to correct the evil is hard to say. As long as untreated human excreta are used for fertilization, the surface waters will be vilely polluted, and that filthy fluid will seep into all the wells in the vicinity, rendering their contents unfit to drink. Undoubtedly, a treatment of the sewage would help some. I recommended in 1929 the trial of a then-new Italian method of metamorphosing the sewage, which method promised well, but I do not think it was ever tried in China, nor have I since heard as to how successful, or otherwise, it proved in Italy. I had an idea that the treated mass might have lost a large percentage of its fertilizing power. Be that as it may, there is probably some as-yet-undiscovered method of treating human excreta so as to render them innocuous without much detriment to their fertilizing capacity; and it is up to the Chinese engineers to discover such a method.

In the modern sewerage systems for large Chinese cities and towns, it will not do, as is too often done in America, to turn the untreated effluent liquid into the near-by natural water courses. Fortunately, the problem of its purification has been solved in both Europe and America, where, unfortunately, the various processes have proved expensive, although generally effective. In China the expense involved would be comparatively small, because of the abnormally low rates of wages there.

A proper solution of these sanitary problems would be a real boon to the Chinese nation; but I greatly fear that it will be many decades before it will be discovered; because so many more pressing problems exist that will take all the money that the Government can rake and scrape together for their materialization.

Power

Power throughout China is nearly all produced by the combustion of fuel—mostly coal—because the vast area of dense

population, where the power is needed, is far distant from the mountains or hills which afford both the water and the head for hydraulic-power production. Quite contrary conditions exist in Japan, where the high ground is only a few miles back from the coast, with the cultivated and the closely populated land lying between. These conditions are conducive to the production of cheap hydro-electric power; and the Japanese engineers and manufacturers have availed themselves of this fine opportunity for both power production and electric lighting.

There is a stupendous amount of power going to waste in the great falls of the Yangtze River (and undoubtedly in other places where the large rivers of China emerge from the mountains); but these places are far distant from the populous plains, and the loss of power in transmission would be excessively large. An easy solution of the problem would be to develop the power at the falls, build the industries near by and below them, and move the artisans and their families to the vicinity of the industries—then ship the manufactured products by water down river and distribute them by rail and highway.

The extreme distance that power can be carried economically by wire is constantly being augmented through the researches of electrical engineers; and herein may lie a partial solution of China's power problem. At any rate, the said problem should be exhaustively studied by Chinese electrical engineers.

There must be somewhere in China, as there are in many other countries, vast supplies of oil and gas which could serve as power producers; hence the entire country should be thoroughly explored for these fuels. This is a job for the Government; and the explorations should be made by foreign experts of the highest class—men who have been doing such work for years and who have done it successfully.

In the case of comparatively small amounts of required power (for instance, in pumping water for irrigation), the humble windmill might be economically employed; and, to keep the supply fairly steady, storage batteries could be used, or possibly elevated tanks for storing water.

The economical production of power by the rays of the sun is still a Utopian dream, but its possibilities should not be forgotten; nevertheless Chinese engineers have more pressing and profitable calls for their time and energy than the search for the production of such power. Let the engineers of other nations who have the necessary wealth carry out such researches.

Irrigation

The little that I saw of Chinese methods of irrigation in 1921 and 1929 did not impress me at all favorably; they were uneconomic and on too small a scale. For instance, I saw water being raised some 4-ft. from a canal by manpower with an old-fashioned tread-mill. Even a bullock walking in a circle and thus operating a pump would have been a better and more advanced method. Again, the water was carried over an embankment and allowed to descend into an irrigating ditch with quite a loss of head and waste of energy. How much better would have been the windmill I suggested two paragraphs back. As irrigation, whenever its use is necessary, greatly augments any farmer's crop production, it behooves Chinese agriculturists to utilize it intelligently, efficiently, and on as large a scale as practicable to suit the governing conditions of the locality.

Of course, most Chinese farmers are too poor to purchase windmills; hence it should behoove the Government to lend them such mills at a reasonable rental that would be large enough to take care of repairs, obsolescence, and insurance against destruction by heavy windstorm. Each farmer should be thoroughly instructed in regard to the proper operation and care of his mill.

All irrigation projects on a large scale should be designed, constructed, and handled by competent engineering specialists, as is done in the United States of America.

Agriculture

Through the energy, ability, and excessively hard work of my good friend, Dr. Thomas D. Campbell, the American wheat king, mechanized farming on a gigantic scale has been developed and perfected in the United States of America. It has reduced to an absolute minimum the cost of wheat production, and has been one of the greatest human-work savers that has ever been evolved. Such a method of farming could be economically employed in China

only on the vast, sparsely populated plains of the North, such as those of Inner Mongolia or Manchuria—and possibly not even there. If it were employed, it would have to be handled, either directly or indirectly, by the Government, which would produce great volumes of wheat, transport it by rail south to the thickly populated areas, and sell it at a merely nominal profit to consumers. Whether this can be done as an economic venture should be determined by a full investigation of all the conditions that would affect the production and distribution. If the scheme should operate successfully, much would be accomplished towards famine relief in China—a matter in which so many Americans have taken a deep interest during the last two or three decades. If ever the Chinese Government should conclude to try out mechanized farming, it ought to retain Dr. Campbell as its consulting engineer, as did the Soviet Government a few years ago.

In my opinion, the ordinary methods of farming in China, while most intensive, are capable of betterment by the greater application of science to that industry.

Afforestation

For China's development, afforestation is a most important desideratum, because in the crowded areas there is a dearth of trees—in fact, as far as I could note, there were almost no natural forests at all. Without forests there can be no humus to soak up and retain moisture, and to hold back a large portion of the rainfall, thus tending to control the floods in the great rivers.

When I was in China in 1921, the science of afforestation was almost unknown there. I saw near the Kin-Han Railway crossing of the Yellow River a pitiful attempt to start a small forest. The little sickly looking trees were set out with the regularity of a checkerboard; and every leaf, every twig that fell was religiously garnered for fuel by the poverty-stricken populace of the vicinity, leaving the ground as bare, hard, and clean as a billiard table. No wonder the trees did not thrive, for the ground surface was so hard that almost no rain could penetrate it, hence there was not enough moisture in the soil to furnish sap for the trees. I should like to take another look at that tree plantation so as to note how much or how little it has grown in the last sixteen years. If ever the Chinese Government should attempt to introduce afforestation on an adequate scale, it will have to force the populace to keep out of the woods and leave the fallen leaves and sticks to rot and form a covering for the bare earth. It will be difficult to make them obey such a regulation, even if they should know the untoward results of their removing the trash; because they are so miserably underfed and underclothed, that they would think only of their temporary warmth from the collected fuel and let the future forest "go hang."

Aerial Photographic Surveying

In 1929 I volunteered to undertake to study and report upon the economics of aerial photographic surveying for China. Experiments thereon were then being made by a number of engineers in both the United States and Canada, so I wrote to several of them asking for information. Unfortunately, their replies gave such conflicting evidence that I had to defer making my report upon the subject until after my return to New York City early in 1930. I was then able to secure several conferences of a few of the most prominent American investigators; and, with their courteous aid, to settle the question. We found that a combination of ordinary surface surveys and aerial photographic surveys would facilitate both the contour-mapping of the country and the making of surveys for railways and highways. I thereupon formally recommended such a combination for those purposes in China; but I do not know what has since been done about perfecting the said combination. It certainly would pay well to perfect it and utilize it in all future surveying of any importance, because it would involve a considerable saving of both time and money.

Mining

It has been my impression for many years that the mining possibilities of China have not yet been adequately explored; but perhaps I am wrong in this opinion. If, however, I am right, it behooves the Chinese Government to get busy and make a thorough survey for valuable mineral deposits of all kinds, including, as before mentioned, oil and gas. The discovery of large supplies of such

minerals would add greatly to China's wealth by reducing importation and possibly even by increasing exportation—a most important desideratum.

Technical Education

Concerning technical education for China, I ought to be able to speak with some authority, because early in 1929, by special request from the Minister of Railways, I made an elaborate investigation on the subject and laid out a new course in Civil Engineering for Nanyang University. My report was so satisfactory to the Minister that he requested me to cable my New York office and ask my partner, Dr. Hardesty, to procure two suitable young engineers to give the new course. He sent two of our assistant engineers, Mr. Harold E. Wessman and Mr. Hebert Davidson, who divided the work between them, serving under my direction. Their service was eminently satisfactory; but at the end of the first scholastic year the University was unable to continue paying their salaries; consequently, they quit and returned to the United States.

The question has arisen as to whether any of China's technical schools should do postgraduate work; and I have been asked my opinion thereon. My reaction to the suggestion is in the negative, because I feel that, in order to give postgraduate instruction properly in engineering, there would be required the services of a large number of high-salaried instructors from abroad; and that it would be more economical and would produce more valuable results, were a select few from each graduating class sent by the Government, at its expense, to the United States of America for a year of such postgraduate study, followed by two years of practice in office and field. From the individual's selfish point of view, it would theoretically be more advantageous to spend the last two of these years in academic study for a doctor's degree; but in the interests of his country it would not; because a doctor's degree does not help a young engineer to accomplish any practical work of value, while office and field experience would do so most assuredly. Of course, in China (as elsewhere) a doctor's degree adds to an engineer's dignity especially when one is young; and it often adds also to his earning capacity, mainly in pedagogy, hence the young graduate cannot be blamed severely for spending time in obtaining an advanced degree, even when he is cognizant of the fact that the said time could be used to much greater ultimate advantage by securing actual experience in designing, manufacture, and construction.

There is much more that I could say about engineering education for China but space will not permit—in fact, I fear that I have already exceeded the limit anticipated when I was asked to prepare a paper.

Present Conditions in Russia

(Continued from page 87)

The high priests of communism from Marx on have sneered at the more moderate elements who wished to bring reforms peaceably. There must be class war. And terror is an insidious habit. The class war has really ended in Russia. The remnants of the old upper classes are powerless. Yet terror goes on, turning now against its own.

The print of Karl Marx's own character is strong on the Soviet regime. Marx quarreled with his early friends and collaborators and was apt to regard a divergent view as a crime. His sympathies, too, were for the workers as a class, not for workers as individuals. It is that way in Russia to-day.

That the Soviet regime will modify its course radically enough to make a vital difference seems unlikely now. It made big concessions already when it shelved, though it did not abolish, world revolution as an integral part of its program. Stalin realistically soft-pedalled world revolution when he faced the necessity of making friends in the capitalist world, finding a sentence in Lenin's writings to justify him, and so he strengthened his country in a world threatened by new wars. So also he introduced widely divergent pay scales for industrial workers and appeased the peasants by permitting them to possess their own garden patches. But, though it appears many of the Soviet's greatest difficulties are due to concentration of the entire economy in the State's hands, one cannot picture the regime now surrendering any significant part of that field, for that would be a break with Marxism that no dialectics could explain away.

The Port of Shanghai

By C. A. MIDDLETON SMITH, M.Sc., M.I.Mech.E., Taikoo Professor of Engineering in the University of Hongkong

(Reprinted from the Dock and Harbour Authority)

SHANGHAI is the premier port of China, through which more than half of the foreign trade of the country passes. It could not have so developed but for the many improvements made in its harbor facilities during the last fifty or sixty years. It is now the commercial metropolis of China, containing a cosmopolitan population of over three millions, and although the vast majority of the people in Shanghai are Chinese, yet almost every nation on the earth is represented. Amongst the millions of Chinese are natives from all of the provinces of China, a land of one written script but of many local dialects. English is now, almost invariably, the language of foreign trade in the Far East, and it is not uncommon for Chinese in Shanghai from different districts to communicate with each other in the English language.

A panoramic view of a portion of the harbor is shown above, in which the main features are the modern buildings in the International Settlement.

The geographical position of Shanghai makes it the distributing port for the commerce of a rich and densely-populated area of China. There is no other port in the world that has a population of the same volume and density, depending for its commercial intercourse with other nations upon facilities for navigation provided by the port authorities. Waterways from Shanghai spread, not only westward across the whole width of China, but throughout the vast alluvial plain of the Yangtze basin, which maintains a population of more than one-tenth of the inhabitants of the whole world. Beyond the Yangtze basin there are navigable rivers and canals forming a net-work of inland communications as far north as Peking and as far south as the borders of Kwangtung province. For centuries there has been water transport from Canton in the South, to Peking in the North—about 1,400 miles—except for a gap of about 30 miles over a mountain track where coolies carried goods in transit between the two cities. So that although Shanghai is the port of foreign trade for practically the whole of the huge Yangtze basin, with 160 million inhabitants, it also serves many other centers of a land containing over 400 million people.

Of the total of 143,978,837 tonnage of powered vessels that entered and cleared in the ports of China, in 1935, the British headed the list with 60,112,641 tons; the Chinese had a total of

41,955,283 tons, and the Japanese a total of 21,919,100 tons. Over 25 per cent of this traffic was to or from Shanghai

The Whangpoo Conservancy Board

The harbor of Shanghai presents one of the best examples in the world of the triumph of man over obstacles formed by Nature. It is the lower channel of the Whangpoo River, about 21 sea miles long. It is entirely due to the practical work, and researches, of harbor engineers that large ocean-going vessels now navigate the Whangpoo River from Woosung to the Shanghai Wharves, and also the approaches from the sea, and along the mouth of the Yangtze River up to Woosung, at the entrance of the Whangpoo River.

The Whangpoo Conservancy Board consists of a nominee of the Ministry for foreign affairs (Chinese), the Commissioner of Customs in Shanghai (foreign), and the Harbor Master (foreign). The principal officer is the Engineer-in-Chief, until quite recently, Dr. Herbert Chatley, M.INST.C.E., whose services are now retained as Consulting Engineer. The Board's funds are derived from a special tax on trade collected by the Shanghai Customs.

The Two Waterways

In order to appreciate the difficulties that have been overcome in providing a safe channel for ocean liners using the port, it should be explained that work had to be done in two waterways, viz., the Whangpoo River and the mouth of the Yangtze. In both channels there were bars that did not affect native junks, nor cause any great inconvenience to foreign ships in the early days of trade in the middle of the 19th century, but in recent years the accumulation of silt, and the increase in total tonnage and in the size of ships, have introduced great complications which have made extensive dredging and training operations imperative.

After the Taiping rebellion (1854) and the signing of a peace treaty between China, Britain and France in 1861, the Chinese Customs Service was organized more or less on its present system, mainly by British officials. In recent years the Chinese Government has assumed greater control, and now fixes all tariffs, Sir Robert Hart, Inspector General of the Customs Service, formulated a scheme for a Marine Department soon after his appointment in



The River Front, The Bund, Shanghai

1862, arranging for lighthouses to be built on the coast, and for inland navigation, buoys and beacons to be set in the approaches of harbors; also pilot services for the several Treaty Ports were inaugurated. Conservancy operations were initiated by the Customs officials, but in the case of Shanghai no large measures were taken until 1905.

The Whangpoo Bars

Hydrographic surveys of the Shanghai channels were undertaken by the British Admiralty, until the Customs Service published their own charts, when the British surveying vessels were withdrawn. The Whangpoo Conservancy and the Chinese Admiralty now do this work. Harbor and conservancy matters were closely studied and, in conjunction with Siccawei Observatory in Shanghai, the Customs' Marine Department kept track of changing channels, marking them, and issuing notices to mariners as they do to-day.

There were two bars in the Whangpoo River, one near the mouth (the Outer Bar) and one about three miles up (the Inner Bar) where the channel was split by an island (Gough Island). From time to time shipping found difficulties at the bars, and as the result of the many representations made to induce the authorities to regulate the channel, and after the Boxer troubles, they agreed to do so, and eventually a Dutch engineer, de Rijke, was appointed in 1905 to eliminate the Inner Bar and deepen the Outer Bar.

The systematic work began with the formation of what was called the Whangpoo River Conservancy in 1905.

After four years of work the notorious Woosung Inner Bar no longer existed, and the Outer Bar was much improved. When the contract with de Rijke expired in 1910, Von Heidenstam, a Swede, was appointed as engineer.

During the last thirty years the whole length of the Whangpoo River, from Woosung to the Arsenal, a length exceeding 20 miles, has been canalised. A regular channel has been formed with smooth curves and gently tapering shores. The contrast between the state of the river in 1906 and 1935 is shown clearly in the diagrams. The area marked "Gough Island" has been united to the shore and increased in size by reclamations, the former channel ("Ship Channel") behind it has been filled in, and the old Junk Channel dredged to form the newer Astraea Channel. The Outer Bar was improved by a convex training wall. There is now a navigable depth of 28-ft. at low water of ordinary spring tide.

The Soochow creek, which connects Shanghai to the Grand Canal of China (800 miles in length), had been silting up badly for many years, and to make a clear channel for lighters, the Whangpoo Conservancy Board dredged the mouth for a distance of about 13 miles upstream. Work commenced in 1931, and by June, 1936, some 1,500,000 cubic yards (1,500,000 tons) of mud had been removed. Both shores of the creek have been intensely developed along the lower seven miles, and flour, silk, cotton and other mills have been built, supply and delivery of goods being made by lighter.

An international Committee of Consulting Engineers, composed of harbor specialists, was appointed in 1921 to consider all technical port problems. The Committee consisted of the following experts:—

(1) General Black, formerly Chief of the U.S.A. Army Engineering Corps; (2) Dr. Hiroi, the adviser to the Japanese ports;

(3) Mr. P. G. Hornell, Consulting Harbor Engineer (nominated by the Chinese General Chamber of Commerce); (4) Mr. F. Palmer (afterwards Sir Frederick Palmer, K.C.M.G.), Consulting Engineer to Port of London; (5) Mr. L. Perrier, a former Chief Engineer of the Suez Canal; (6) Mr. P. J. Ott de Vries, a distinguished Dutch expert on harbors, together with the Board's Engineer-in-Chief.

In their Report, which was published in June 1922, they advised the port authorities that a draft of 33-ft. would probably be required to accommodate larger vessels, and stressed the fact that their recommendations were commercially sound. They proposed to raise funds by means of Port Debentures of nearly \$15 million (silver) dollars.

The latest returns (1935) show about 17 million tons of shipping entered at Shanghai; the port is high on the list that gives the tonnage entered recently in the leading ports of the world.

The outstanding geographical, geological, commercial, and even political, facts concerning Shanghai are intimately connected with China's giant river, about 3,200 miles long, the Yangtze Kiang.

Geologists declare that, long ages ago, a great Asiatic Mediterranean Sea covered what is now Central China, penetrating more than a thousand miles inland from the present coast line. Into that sea flowed the Yangtze. It leaves the hilly country at Ichang; the great alluvial plain, across which the main river, about 1,000 miles in length from Ichang to the sea, winds its way, is as much a child of the river as is the deltaic land more recently deposited around Shanghai.

The Yangtze rises amongst mountains 17,000-ft. high in Tibet, and has a strong current in a channel 750-ft. wide, some 3,000 miles from its mouth. From its source, to about 1,600 miles from the sea, it falls from 17,000-ft. to about 800-ft. above sea level—an average slope in the river bed of 9½-ft. per mile. The discharge into the sea averages 1,000,000 cubic feet of water per second. The maximum discharge is nearly 3,000,000 cubic feet per second.

Mr. Von Heidenstam estimated that 15,000 square miles of delta land were laid down by the Yangtze in 10,000 years. This is an average rate of 1½ miles per annum. He gave the average height of the Yangtze delta as from 12-ft. to 15-ft. above sea level. The area of the delta is nearly 50,000 sq.

miles, and supports a population of over forty million people, and behind it is the Yangtze basin with a further 120 million inhabitants.

Authentic Chinese records, that go back nearly 2,000 years, give evidence of the many changes that, in those times, had taken place in the direction and volume of the waterways around the delta in which Shanghai is situated. Shanghai is not mentioned in the early records, and even the native city is only about 1,000 years old. Geological and geographical facts give some idea of the practical problem of the conservation of the Whangpoo River and its outlet into the mouth of the Yangtze. It is upon the maintenance of the channel to the sea that the present and future prosperity of Shanghai as a port depends.

The Silt Deposits

It is not the discharge of the Whangpoo that maintains a navigable channel, though its aid is important. Rather it is the inflow of tidal water from the Yangtze, together with the scouring



The Chinese Maritime Customs House and Offices of the Engineer-in-Chief, Shanghai

effect of the combined outflow. A full spring tidal influx amounts to 4,400,000,000 cubic ft. of water, while the volume discharged by the same tide is 5,000,000,000 cubic ft. Thus the contribution of the drainage basin of the Whangpoo amounts to 600,000,000 cubic ft. per tide.

The silt in the Whangpoo comes mainly from the Yangtze, the water having silt content which is at a maximum about 500 parts per million at spring tides.

The Yangtze brings down 500,000,000 tons of solid matter each year, the area covered being about 30,000 sq. miles. Much of the silt is discharged into the Pacific Ocean in a very finely divided state.

Early History

It was not until A.D. 1075, nine years after the Norman Conquest of England, that Shanghai had established itself. It was then known as Shanghai-chen (or market). Later native writers called it the "City of Reeds."

It was not of much importance until about A.D. 1554, for before that date it was unwallled. There was then a need for protection, as Japanese raiders—and probably Chinese pirates—levied tribute. But the real history of Shanghai commenced with the arrival of the British fleet of steamers, warships, transports, and the survey vessel *Blenheim*, at the mouth of the Yangtze in 1842. Soon after that event Shanghai was occupied by the British forces. Immediately British naval survey vessels obtained data about the channels around the port. The city was only occupied by British troops for four days, but the British naval surveys continued for some years until the Chinese Maritime Service continued the work.

The object of the British was not war, but trade, the soldier being quickly replaced by the Consul, and the men-of-war by the ships of commerce.

One of the earliest acts of the first British Consul was the delimitation, with the Chinese authorities, of the limits of the port and the dimensions of the anchorage. The first was 13 miles long, from the city to the mouth of the Whangpoo at Woosung. The latter was 3,000-ft. long, 1,700-ft. broad, leaving a junk passage of from 600 to 800-ft. wide.

British Interests in Shanghai

In spite of the sharing by the British pioneers in Shanghai of their rights with other nationals, the evolution of the now famous International Settlement has always been mainly due to the enterprise and initiative of the British residents. They have owned



A view of the Whangpoo River at Shanghai, opposite The French Bund

much of the land in the International Settlement—once a mere mudbank, now a huge city built on reclamations—and they have controlled many of the chief commercial enterprises.

The premier position of the British flag in the China coast trade for many years, and the pioneer efforts of the British, in connection with power-driven vessels on the Yangtze, and other inland waterways, have also helped to place them in a key position, not only in the Municipal Government of the International Settlement of Shanghai, but also to influence the Maritime Customs and Conservancy and other schemes connected with the Port of Shanghai.

It soon became evident to the pioneers in Shanghai that close attention and much expert advice was needed for port and harbor works if foreign trade was to be developed as they desired. The problems have been solved as a result of great technical ability and clever administration.

The Approaches to Shanghai

The China Sea, off the mouth of the Yangtze River, is open towards the N. and E., with depths exceeding 10 fathoms at about 30 miles off the China coast. There are strong and rotary tide currents; but the route to Shanghai is open and well marked with lightships and lighted buoys.

There is a safe open roadstead off the entrance to the Whangpoo at Woosung for vessels that may not berth in the river at Shanghai. It has a length of some six miles available, with a width of from 1½ to 2 miles between the 30-ft. low-water contours. In the deepest channel near to the South side there is 50-ft. or more, the bottom consisting of mud or fine sand.

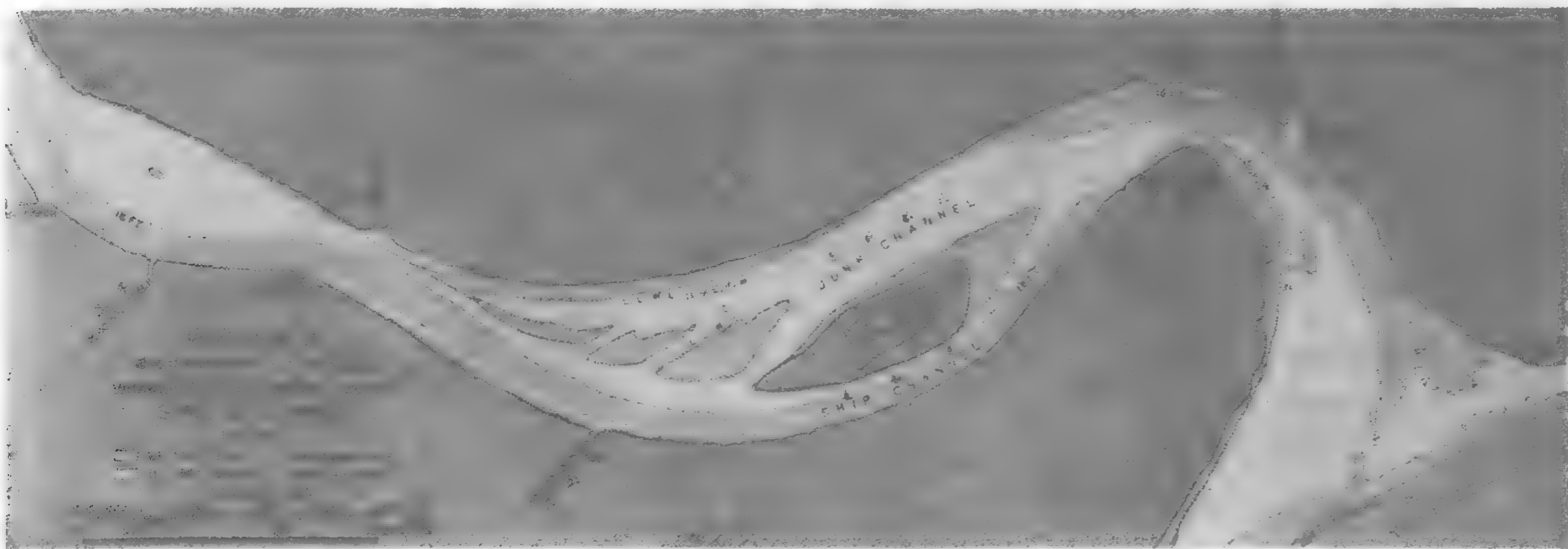
Vessels anchoring at Woosung use lighters for the transfer of cargo, which is then towed to Shanghai. When there is a strong wind, however, the transfer is difficult, and although there is no danger to large vessels properly anchored during rough weather, lightering becomes impossible and the safety of the lighter is endangered. It is estimated that lighterage is prevented about 20 per cent of the time, and it is difficult to work both sides of a ship 50 per cent of the time.

The Yangtze Estuary

The general authority on the Yangtze is the Yangtze River Commission. This Commission, which was inaugurated in 1922, has small funds and little experience, but is supervised by The Hydraulic Engineering Bureau of the National Economic Council. Its present activities are chiefly confined to surveying and giving advice to local authorities.



Loading a typical river steamer with coal



Whangpoo River in 1906

The Whangpoo Conservancy Board has been interested in the Yangtze Estuary since 1916, and the joint representatives of the Board and shipowners, from 1921 to 1930, finally induced the Executive Yuan of the Central Government of China to authorize the Board to dredge the great Yangtze Bar. Shanghai is the only place that is in the least degree interested in the Yangtze Bar, since any ship that is hindered by the present bar would be equally hindered by the crossings above Woosung before reaching ports higher up the Yangtze.

The purchase of a dredger costing over £151,000 in 1935,* and the contract for what is probably the most powerful dredger in the world (costing £231,700), recently signed, is part of the effort to improve the channel in the Yangtze Estuary.

The Board's Work

Constant dredging is necessary in the Whangpoo in order to maintain a channel of sufficient width and depth to allow modern vessels to enter and leave the port. The enormous deposits of silt, not only in the channels, but especially at the bars, have made it imperative to purchase expensive equipment and to maintain a large staff at work on dredging operations. The results obtained have been remarkable and are of great interest to harbor engineers. The Chinese have willingly co-operated and, in recent years, well-trained Chinese engineers have taken an active part in the work. It is significant that an experienced Chinese engineer, Mr. C. P. Hsueh, has succeeded Dr. Chatley as Engineer-in-Chief of the Whangpoo Conservancy Board. Mr. P. N. Fawcett, formerly Engineer to the Liao River Conservancy, has also acted as Technical Adviser.

Since 1905 a large number of publications, containing a great deal of technical information, have been issued by the Board, while Dr. Herbert Chatley also contributed to various engineering societies, papers on many valuable researches and on the results of his experience in connection with conservancy problems. The following details have been obtained very largely from the above sources. To Dr. Chatley the writer is greatly indebted for the supply of publications, etc.

The duties of the Board are to provide and maintain a deep channel from the sea to Shanghai, to undertake the new works necessary to improve the existing channel, and to help riparian owners in dredging in front of their wharves.

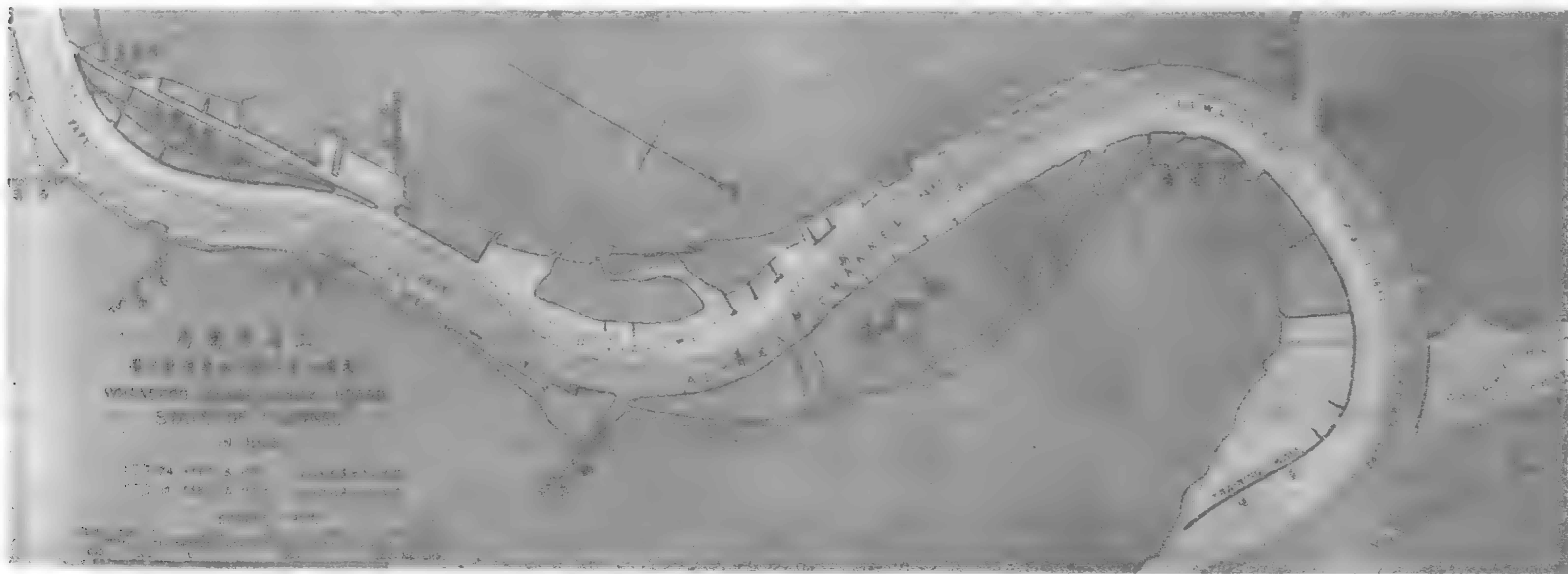
The Board, which has entire control of its funds and finances, derives its income from a Conservancy Surtax of three per cent on the Shanghai Maritime Customs dues, one and a half per mille on duty free goods, 0.045 per cent on treasure, and the proceeds from the sale of foreshore lands.

The Board's general jurisdiction extends to the tidal limits of the Whangpoo between high-water lines, and within these limits it may prevent any operation which would be harmful to the river. Its control of foreshore lands extends from the Kiangnan Arsenal to the Yangtze, and between the high-water lines of spring tide, as they were in the year 1906.

The Whangpoo Conservancy Consultative Board

The Consultative Board is an advisory body, consisting of six members, one member being appointed by the Chinese Chamber of

* See *Far Eastern Review*, December, 1937



Whangpoo River in 1935

Commerce, and the other five by the five nations having the greatest tonnage entering and clearing at Shanghai.

The duties of this Board are to watch conservancy proceedings on behalf of the commercial interests of Shanghai, both Chinese and foreign; to make representations to the Conservancy Board if they think it necessary; and if not satisfied to refer the matter to a Consular Committee for diplomatic settlement through the Ambassadors.

The Whangpoo Problem

In 1905, when the work was commenced, the bar at the mouth of the river (Woosung Outer Bar) had a depth of only 15-ft. of water at the time of extraordinary low tides. Three miles up, the river divided into two channels, one very shallow of 8-ft. depth and only suitable for junk traffic, and the other with a bar having a depth of only 10 or 11-ft. at the recorded lowest low water (Woosung Inner Bar). From the upper end of the island, between these two channels, up to the International Settlement, the channel was wide, with shoals rising at several points. In the harbor itself the deep channel was too narrow; in two places the whole river was too narrow; and there was a bar commencing to rise at Wayside.

All these defects were becoming worse, so that it is certain that, unless regulation work had been undertaken Shanghai, by this time, would have become inaccessible to large ships. As it is cheaper to carry goods in large ships than in small ones, either the big ships would have gone to other ports or else they would have to unload into boats in the Yangtze. Whichever method was adopted, the cost would have been greater, and Shanghai would have suffered from the increased expense and probably still more from the diversion of business to other places.

The Whangpoo River is a drainage channel, whose basin extends to hills in the west, and is bounded by the Yangtze River in the north and north-east and by Hangchow Bay in the south and south-east. Except for the hill slopes at the Western watershed, and a few isolated hills, the channel is very little below the level of the plain. At the mouth, it is over 2,000-ft. wide, with a gradual narrowing above Shanghai to a system of lakes. For about 60 miles up from the mouth it is tidal, with a strong tidal scour. It has maintained a channel exceeding the dimensions required for the run-off, and so caused the river to meander and spread in the usual manner of rivers in alluvial plains, the result being a succession of pools and crossings and the bar at the entrance.

The difficulty has been to so regulate the channel to a normal width as to obtain a maximum and a fairly uniform depth, after making full use of tidal currents and other natural aids.

In 1906 the Conservancy laid down the normal lines within which the channel must be kept. These lines, which are the ultimate limits to which pier-heads, wharves and pontoons may be built, are about 1,400-ft. apart at the upper end of the harbor, gradually expanding to about 2,400-ft. at the mouth. They are also the ultimate legal limits for riparian landowners. Up to the end of 1935 a total of 56,620,000 cubic yards of mud have been dredged from the channel.

A comparison of the states of the channel in 1906 and 1935 will enable the reader to realize the work carried out by the Conservancy Engineers during that period.

To guide the water between the normal lines, training walls of various types have been built in many places, with piles, brushwood-mattresses, caissons, stone, etc., etc., and where the channel was split by islands or shoals, one of the two branches—the Ship Channel—was closed by heavy dams, and the other one made into a first-class waterway.

In two places where the river was too narrow, it was widened by dredging.

Very large areas have been reclaimed by thus narrowing the whole channel, with the result that the deep channel is wider and the tidal currents run unimpeded from the Yangtze through the smooth gently-curving course. At the points where the land bulges out into the water the mud continues to settle, and at these places some 1,000,000 cubic yards have to be dredged each year.



Shanghai Dockyards, Yangtszepoo Dock No. 1

The following is a general summary of the work that has been carried out by the three able Engineers-in-Chief, viz., de Rijke (1906-1910), von Heidenstam (1910-28), and Chatley (1928 to May, 1937). They are: (1) A training wall on the left bank at the mouth, one mile long, of heavy marine type. (2) The closure of the "Old Ship Channel" behind Gough Island, together with deepening the "Old Junk Channel," now called "Astraea Channel." (3) Training works at the mouth, to form a smooth trumpet form, joined to the shore of the Yangtze. (4) Various training works opposite Arsenal and below Pootung Point, etc., and numerous reclamations and buildings. (5) Dredging, exceeding 60 million cubic yards, practically all of which has been pumped to the shore. (6) Dredging the Soochow Creek (the principal tributary) in conjunction with the Shanghai City Government.

It is difficult to estimate in sterling the total cost of the Board's activities, on account of the great fluctuations in exchange values. It is given as 45 million silver dollars up to end of 1935, and £4,000,000 is probably a conservative estimate.

Continuous dredging of the Whangpoo is imperative. The Board aims to produce 30-ft. at lowest water over the bars.

Thus the river was converted from an irregular, and rapidly deteriorating creek, into a good shipway with a least navigable depth of 26-ft. at extraordinary low water.

Shanghai Harbor

The harbor has accommodated 156 merchant vessels and 22 warships, and about 500 junks at one time. The largest vessel was 657-ft. in length and had a 30-ft. draught, and could be berthed at a wharf or at a head-and-stern mooring.

Vessels up to 25-ft. draught can pass through the whole length of the harbor at extreme low water, and at high water vessels up to 32-ft. draught can be accommodated.

The area of the harbor between normal lines is about 4,810 acres, and between 18-ft. contours is 3,230 acres (approximately five square statute miles). There are eight main bends. Opposite the French Settlement is a low crossing and bar, and a sharp, narrow and deep right-handed turn (Pootung Point). Just below is the "Wayside bar," with 28-ft. at low water on the Shanghai side. There is then a long deep stretch (pool) on the right side extending almost to the Tung Kou Creek mouth.

There are eight creeks within harbor limits on the Shanghai side, Soochow Creek being the most important.

The highest speed of tidal flow (Flood, Spring) is 2.6 knots.

The frontage of the International Settlement above Soochow Creek consists of a public Bund, 3,500-ft. long, of which 500-ft. is a part of a Public Garden, and 3,000-ft. is used for discharging lighters and promenade.

The French Settlement Bund is 3,800-ft. in length, 3,170-ft. of which is a public quay, with public and private pontoons, and the remaining 630-ft. is public road with four public pontoons.

Ships are coaled almost entirely by hand labor from cargo boats or wharves, and practically all the loading and unloading is done by coolie labor, two exceptions being the Kailan Mining Administration and the Shanghai Power Co., who use mechanical apparatus.

There are eleven dry docks, varying in length on blocks from 640-ft. to 235-ft., giving a main average exceeding 400-ft. in length for the eleven. Five belong to "Shanghai Dockyards," three to the Chinese Government, two to small shipyards, and one to the Conservancy.

There are 68 head-and-stern mooring berths in the stream, including four naval berths, four berths for Customs cruisers, two berths for cable ships, and three berths for vessels with gasoline. Vessels may not moor with their own anchors in the harbor.

Wharfage dues are collected on all goods imported by vessels into Shanghai, or exported by vessels from that port. Goods transhipped at Shanghai or re-exported do not pay wharfage dues.

All the wharves in Shanghai are privately owned, so that berthing arrangements must be made with the owners. The provision of public wharves and piers was recommended by the 1921 Committee of Consulting Engineers, the estimated cost of the first stage being about 15 million (silver) dollars. The Central Bank has built a new public wharf ("Jukong Wharf" referred to below) which conforms to this scheme. The City Government of Greater Shanghai has started, in a small way, to provide public wharves, and has a large paper project near Woosung. Three experts from the League of Nations in 1932 disapproved of the wet-dock scheme included in the latter plan. There is ample opportunity for private riparian development, and this will probably take place.

The wharves of Shanghai are situated on both sides of the river, and accommodate both ocean liners and a large number of river steamers using the Yangtze and adjacent waterways.

The frontage served by pontoons totals 48,560-ft., of which about half is on Shanghai side of the river and half on Pootung side. There are 26,345-ft. of pile wharves, two-thirds on the Pootung shore. Bunding, without wharves or pontoons, is of about equal length on each side of the river, and totals 73,055-ft. The unimproved bank is of length 99,800-ft., half on each shore. The creek mouths frontage is about 2,500-ft. on each side of the river.

Of a total frontage of 253,475-ft., the British own 36,670-ft., the Japanese 23,615-ft., the Americans 13,730-ft., and the French 3,130-ft. The public frontage totals 87,290-ft., the privately-owned Chinese frontage is 36,670-ft., and a length of 87,290-ft. is given as undeveloped or agricultural.

Much of the cargo is handled by lighters from the outer side of ships at wharves, or moored in mid stream. The lighters moor in the shallower part of the harbor. There are 20 tug boats belonging to the lighter companies available for swinging and towing large vessels and for towing lighters. Chinese cargo boats are not usually towed but are worked by stern oars called "Yulohs." The harbor is deficient in mechanical equipment.

Shipyards and Docks

Vessels up to 14,000 tons dead-weight have been built in Shanghai, but the port does not excel Hongkong in the matter of shipbuilding and ship repairing. There are a number of small Chinese yards that build launches and native crafts.

The Shanghai Dock and Engineering Co. has recently combined with the New Engineering and Shipbuilding Works, and is now known as "Shanghai Dockyards." This concern owns at present five dry docks. The longest length on blocks in one of these is 584-ft., with 62-ft. breadth at entrance and 20-ft. depth on sill.

The Chinese Government owns the Kiangnan Dock and Engineering Works. The dry dock with the longest length on blocks (640-ft.) has a breadth at entrance of 80-ft. and depth on sill of 23.5-ft.

The mechanical workshops of "Shanghai Dockyards" are well equipped. This firm easily takes the lead in this class of work for Central and North China. It is extremely well organized with a well-qualified foreign and Chinese staff. As Shanghai is not a terminal port on the Suez or Pacific routes, it follows that most of the repair work in Shanghai is either emergency or for the

smaller vessels. The ships built ordinarily do not exceed 5,000 tons. It is probable that, as the Chinese develop their industries, Shanghai will become a more important shipbuilding and ship repair center.

The Jukong Wharf Construction

Dr. H. H. Kung, Finance Minister, organized a Planning Committee for the Jukong Wharf, the site of which is North of Jukong, and below Point Island Channel. The wharf is a part of the scheme to facilitate overseas shipping and to develop Greater Shanghai, and it is claimed that although the wharf is much below the commercial center of Shanghai, a motor-car will cover the distance in less than 20 minutes.

The first step in development was the reclamation of a very large area of low-lying fields, and the construction of two sections of reinforced concrete wharves, with warehouses, and other buildings. The estimated cost was five million dollars, financed by the Central Bank of China.

The Changing Trade of Shanghai

The general decline in trade in Shanghai in recent years was not entirely due to the situation in China. On the contrary when we consider the many adverse outside influences, more unfavorable results might have been expected. The value of world trade was relatively in no better state, for in 1935 it was estimated at only 35 per cent of that for the year 1929, but China's foreign trade for 1935 represented 55 per cent of the figure recorded for 1929. And although China's adverse balance of trade in 1931 was 1,087 million dollars, in the following years it showed annual reductions of 132 millions, 222 millions, 238 millions and 152 millions of dollars. Thus, although the total value of trade declined, the adverse balance of payments was reduced by nearly 70 per cent in the four years since 1931. That is the more remarkable as there has been a great decline in China's invisible exports in the form of remittances from overseas Chinese and foreign investments. Moreover, before 1931, there was a favorable balance of trade for the Province of Manchuria, now under Japanese control. The Manchurian trade was valued with a favorable balance on export account of about 190 million dollars. Shanghai trade was greatly affected by all these factors.

It is noticeable that since 1919 there have been great structural changes in China's import trade. Whereas in 1919 textiles accounted for 32.98 per cent the percentage was only 5.43 of the total in 1935. Machinery, vehicles, chemicals, mineral oils, etc., have each greatly increased in percentage value.

The enormous increase in textile mills and other power driven industries in Shanghai in recent years has resulted also in certain manufactured goods, which were formerly imported, now being exported from Shanghai.

The great demand for modern buildings, modern conveniences, such as plumbing, electric supply, radio, etc., has created a great change in the type of goods imported to Shanghai. Nor must we overlook the growth in national feeling which encourages local industries. The Chinese Government, through the newly-established National Economic Council, and with the help of foreign experts, is doing its utmost to increase the number of Chinese trained in applied science subjects abroad and in China. The reflection of all these new factors can be seen, each year in greater magnitude, in Shanghai. The modern banking system, controlled by Chinese, the insurance and industrial companies, etc., are new features that record great changes. It should be mentioned, however, that the premier bank concerned with foreign trade is the Hongkong and Shanghai Banking Corporation, whose directors are British. Also most of the important commercial firms concerned with trade in China are controlled by Europeans.

The fact that industrialization in Shanghai, and the introduction of tariffs now enables her to manufacture goods formerly imported, has caused foreign firms to establish factories in the city to cultivate the import trade in heavy industries. It is in connection with the import of modern machinery, steel, vehicles, etc., that the foreign firms are now chiefly concerned. They are also doing their utmost to encourage improvements in farming, in flood prevention, river conservancy work, transport facilities (including not only roads and railways, but harbor facilities) and stabilized currency, in order to increase China's exports.

Japan's Electric Power Policy

(From The Tokyo Gazette)

STATE control of electric power in Japan, when efficiently conducted, will constitute an essential and basic step in the augmentation of productive power, the promotion of industries, and the security of the economic life of the people at large. Under existing circumstances, its bearing upon the strengthening of national defence is great. Nationalization of electric power is therefore one of the most important economic problems, and at the same time is a problem directly and vitally related to the existence and development of the Japanese nation. When viewed in this light, the urgent need for a measure to effect State control may be fully appreciated.

Electricity has now taken the place of coal as the pivotal factor in modern civilization. In point of fact, it forms to-day the very foundation of industry and the essential element in the development of contemporary life. In certain industries electric power may almost be regarded as the raw material, and in certain cases of exports from Japan the increasing amount of commodities may essentially be classified as the exportation of electric power itself. On the other hand, cases have increased in Japan in which the efficient operation of electric power has enabled a check in the importing of certain commodities.

The much discussed problems of development of agrarian communities and electrification of homes also can be solved, to a considerable extent, by the cheap and abundant supply of electric power. In other words, by substituting human labor with electric power and by economizing the labor thus saved through the full utilization of power a totally new phase will be inaugurated in the crude, naive system of Japanese agriculture. To illustrate further, the improvement in irrigation and drainage facilities, which is the first requisite for the increase of better rice-fields and crops, can be effected only by supplying power to agrarian communities in abundance and at moderate rates.

Another important point to be noted here is that to utilize fully the water power which is one of the most valuable natural resources peculiar to the topography of Japan is, in positive terms, to realize the greatest of Nature's blessings and, in negative terms, to economize on other sources of power such as coal and petroleum which can be substituted by water power. The real significance of this point can be brought home when we are reminded of the fact that this latter set of resources, with which Japan is not blessed by nature, constitutes one of the basic elements in the material strength upon which a modern nation stands.

With regard to the bearing of the power problem upon national defence, Great Britain's experience during the World War is sufficient to prove its serious nature. With her many small-scale generating systems, Great Britain encountered serious difficulties in supplying power which had come to be demanded urgently and increasingly by munition plants. It is therefore an unqualified necessity for the efficient mobilization of power in time of emergency to be fully prepared in time of peace with a complete plan of connecting and adjusting all systems of power distribution. To plan in time of peace for the development of chemical industries through adequate supply of electric power with a view to facilitating their conversion into munition industries in time of war is certainly a practical measure for effecting economy in national defence.

Hence, State control of electric power is perfectly justified on economic as well as on national grounds. Furthermore, the facts that the power industry requires stupendous equipment, that its enterprises tend naturally to monopoly, that large-scale and unified operation alone can ensure advantages in construction and management, and that it has both national and public uses call necessarily for a single system of unified operation and State supervision. The necessity for such a drastic measure is, in fact, born out of technical as well as political considerations. This too accounts for the resuscitation of the problem of power control as an important national measure.

Practical Measures for Power Control

The ideal to be attained through control of power is to bring about the highest state of technological efficiency in achieving

nationalization of power supply, by co-ordinating all power equipment in the country for unified national purposes and by operating it accordingly, thus eliminating abuses of monopoly and reducing costs of generation. Because of such possibilities, the policy of State power control has long been advocated by thinking people both in learned and business circles, creating favorable repercussions among the general public.

However, the realization of State ownership and management of the power industry is difficult in view of the present financial condition of Japan, for it entails the annual issuing of enormous public loans for the development of new power sources. And although these are in the nature of transfer and productive loans under the special account, they cannot but bear seriously on the whole of the public loan policy, inevitably bringing about the expansion of national finance. In particular, the present emergency in Japan's national life makes it well-nigh impossible to carry out such a measure. Even if it were possible to purchase the whole equipment, changes in financial policies, rejection of the budget by the Diet and other unfavorable developments might interrupt the execution of the expansion and improvement of the equipment, and the regulations concerning the governmental accounts system and other limitations might interfere with its economical construction and maintenance.

Another conceivable measure for control is the amalgamation of the "Big Five" power companies. Accordingly, it has been proposed to amalgamate the Tokyo Electric Light, Tokyo Electric Power, Daido Electric Power, Japan Electric Power and Ujigawa Electric Power companies, whose fixed assets aggregate Y.1,500,000,000 and whose total generation capacity covers the greater part of the aggregate total of the entire capacity in Japan. This amalgamation would establish connections in generation and transmission systems, and bring an increase in the load and economy in the reserve equipment, and consequently realize the purpose of controlling electrical undertakings in Japan. In fact, this measure would go a long way toward attaining the desired purpose in respect to power economy in terms of equipment. From the viewpoint of national economy, however, it would only intensify capitalistic monopoly, resulting, increasingly in threatening consumers and destroying the thorough, efficient working of governmental supervision.

The last measure proposed is one of planning for a co-ordinated unification of all the generation and transmission systems by means of voluntary achievement of common account management by the "Big Five." Though not without certain merits, this measure would, through introduction of common account management, make the existence of individual participating companies merely nominal. By framing various plans perhaps well intended but by no means free from considerations of conflicting interests between the individual companies, this measure would defeat the purpose of unification. It cannot, therefore, be expected to prove effective in developing power sources in accordance with national policy, nor can it safeguard itself against the evils of monopoly which similarly form an obstacle in the preceding amalgamation measure.

Yet these considerations will in no way serve as refutation of the necessity of power control. They indicate the necessity of careful study in the matter of the measure finally to be adopted, in view of its effect upon existing enterprises, and on business efficiency after the enforcement of control. Accordingly the Government considered it wise to seek co-operation of governmental and private experts, those actually engaged in the industry and representatives of consumers, and created the Electric Power Commission to render a decision on a concrete measure for the early execution of power control.

This Commission has consequently made the recommendation that State power control is most exigent and that it should be carried out through the co-operation of governmental and private interests. In order, however, to ensure penetration of the will of the State in carrying out the control and to realize the ideal of co-operation between the Government and the people, giving full scope to the merits of each party within the structure so designed,

it has been recommended that the basic matters regarding the operation of the industry and other matters pertaining to its business aspect should be in the hands respectively of the Government and private institutions.

After the thorough examination of the contents of the recommendation, the Government has approved it as embodying the most appropriate practical measure for the purpose, and has framed, on its basis, the outline of a national power policy, which is to be proposed at the 73rd session of the Imperial Diet as a legislative bill.

Outline of the Power Policy

The following are the essential points of the proposed national power policy.

I.—SCOPE AND EXTENT OF CONTROL

- (1) Generation and transmission of electric power by means of the equipment which is necessary for State control and which is described below shall be controlled by the Government :

- (a) The important new equipment for hydraulic generation, which includes the existing hydraulic generation equipment that cannot be dispensed with for rational utilization of water power resources.
- (b) The important equipment for thermal generation.
- (c) The important equipment for power transmission.

The physical features of Japan can best be described as narrow and long. The main islands are traversed in the center, throughout their entire length, by a chain of mountains, forming a series of available heads of water. Being also a sea-girt country, Japan abounds in rainfall, naturally affected by the seas. These topographical and climatic features provide throughout the country rivers extremely rich in volume of water and in head, thus providing the nation with an abundance of water power sources which is an invaluable blessing for a country deficient in natural resources.

According to an investigation conducted in 1918, the total quantity of stored water power in Japan was estimated, on the basis of the average volume of water and in terms of electric power, at 11,000,000 theoretical kilowatts. It should be noted, however, that as the quantity of water power already developed to this date amounts, in terms of electric power, to 5,000,000 theoretical kilowatts, the quantity left undeveloped does not exceed 6,000,000 theoretical kilowatts. This forces the conclusion that, if a quantity representing 400,000 or 500,000 kilowatts is developed annually to meet the growing demand for electric power, the total available quantity will be exhausted in about ten years. Such a state of affairs with reference to water power which is the principal source of electric power is certainly serious, in view of the national and social significance of the latter. It is therefore imperative that utilization to the fullest extent of human intellect of undeveloped water power resources should be made. By so doing the quantity of water power as the source of electric power can be doubled under the present state of technical progress. Particularly, if the regions ranging from the point of the higher head upstream to the point of the lower head downstream which were not approached from business and technical points of view in 1918 are explored for the perfect development of new resources, the stored quantity of water power in Japan is certain to rise, again in terms of electric power, to more than 20,000,000 theoretical kilowatts.

However, in the situation prevailing in the power industry, in which many private institutions with conflicting interests are operating and in which plans for developing resources are being made only on the basis of their limited economic power and of the consuming capacity of their constituencies, such plans cannot be expected to be carried out in a way most effective for and satisfactory to national purposes. It is therefore essential that the undeveloped resources at least be placed under direct national control so as to make it possible to exploit them positively and rationally exhausting all material and intellectual means and taking into consideration the physical features and surroundings. In connection with the development of the new resources, conservation works such as large-scale afforestation and storing of water should also be carried out so that relations between the hydraulic power industry and other water utilization activities such as fisheries, the floating of timber and irrigation works may be kept

free from friction. Such friction has in the past constituted a noticeable factor in higher construction costs in the work of developing water power resources and the consequent higher costs of generation. Such maladjustment can be eliminated only by means of State control.

The proposed plan of State power control, unlike the plan drawn up last year, does not, in principle, make water power resources already developed the direct objective of its control. This exemption is made out of considerations that the volume of water in those resources which can be utilized for purposes of generation is more or less fixed according to the scale of the existing equipment, that the control of the transmission equipment will be sufficient for the purpose of their full utilization, that the economy achieved in providing capital funds for the special company to be created in this connection will make smaller the possible effect of this control measure upon economic circles, and that the saving of time by making unnecessary such a procedure as appraising the invested equipment will hasten realization of the State power control policy demanded by the present emergency. However, the equipment such as that for the purpose of supplementary supply and of the peak load which is used in a similar way as that for thermal generation, and the hydraulic generation equipment already in operation which must be radically reconstructed in order to ensure better and more complete utilization of resources should necessarily be placed under State control.

In regard to point (b), the technical progress of hydraulic generation in recent years has greatly enhanced the value of thermal generation. This progress is of particular value because of the fact that, since the volume of river water available for generation purposes is developed on the basis of that for three months, the joint use of the thermal generation method is essential to make up for the shortage of the volume of water, thus enabling electric power of high value to be obtained all the time. After the coming into force of the proposed measure of control—when water power resources are developed on a large scale and transmission connections are completed throughout the country between different water systems—it will be particularly important that the existing thermal generation equipment be reconstructed or put into different methods of operation, with a view to employing the plant according to priority in respect to the efficiency and scale so that the reserve heating power is economized and preserved for a time of emergency.

With regard to the thermal generation equipment to be constructed, it must also be efficiently planned on such a scale as to keep itself in close relation to the existing hydraulic generation equipment, with the result that utilization of water power resources is effectively made. Such planning will certainly contribute toward economy in fuel consumption and in the lowering of generating costs. The existing thermal generation equipment, however, being under the divided ownership of industrial concerns with conflicting interests, cannot be expected to be operated in harmony and co-ordination. Further difficulties are found in the fact that, as different owners of the equipment operate it in accordance with their own special circumstances, some of them suffer from having the greater part of their large-scale and highly efficient equipment lie idle while others in adjoining districts are operating their small-scale and efficient equipment to the fullest extent of its capacity at higher costs of generation.

This state of affairs imposes a heavier burden on consumers, runs counter to the conservation of fuel resources, and creates in consequence many undesirable national and social problems. Here are grounds for attaching great importance on the part of the Government to the thermal generation equipment and for placing it within the scope of direct State control.

Now let us consider point (c). Rivers differ greatly in volume of water according to their geographical situation, while the demand for electric power differs considerably both in respect to the quantity and in respect to the seasonal fluctuation according to the method of its use. Consequently, economy in the use of electric power cannot be achieved until connections between transmission lines and between different water systems are completed throughout the country. Without such connections it is absolutely impossible to make up for shortages in the total volume of water and in the aggregate total of the volume of all resources, through the efficient operation of thermal generation. Without them it is impossible to make adjustment of supply and demand, especially in cases where there are demands for power differing in load. These connections, again, are essential for increasing the reserve working

capacity of the equipment and its utilization efficiency, and in consequence for cheap and abundant supply for power. Divided ownership and utilization at will, however, of the transmission lines form serious obstacles in carrying out such measures as supplying surplus water power to districts where shortage in the volume of water is supplemented by thermal generation, such measures as eliminating waste in transmission equipment and improving its utilization efficiency, and such measures as concentrating all the electric power available for emergency purposes by mobilizing all the generation capacity. State control of the important transmission equipment, therefore, constitutes a fundamental provision in the proposed national power policy.

- (2) The equipment coming within the scope of State control as described in the foregoing paragraphs shall be constructed by a special company created for the purpose, and that which is already in operation shall be placed at the use of the new institution as the investment of its owners.

The electric power generated by the existing equipment for hydraulic generation which is connected with the above-described transmission equipment shall be purchased. In certain cases, however, its transmission by means of the equipment owned by the new institution may be allowed.

Appraisal of the invested equipment and decisions on the rate of power purchase shall be made on definite standards of computation and on the approval of a Commission which will be specially created for the purpose. With regard to the loans secured on the invested equipment, the Government shall take adequate and just steps necessary for safeguarding the rights of the creditors.

The existing power equipment coming within the scope of the control of the State is required, as has been made clear, to be invested in the special company. Public utility enterprises such as electric power, local railways, tramways and waterworks are generally stipulated in law as enterprises which can be expropriated by the State or public bodies on grounds of their being licensed, utility enterprises. It is inevitable, therefore, for the power industry to be forced to invest its equipment in the enterprise having a definite national purpose in order to fulfil the mission of the industry which has become increasingly momentous in recent years.

Since the proposed measure includes the enforcement at the will of the State of transfer of property rights in the form of investment in the new company, the appraisal of the invested equipment should be made in an adequate and equitable way, to the complete satisfaction both of the investors and of the nation. Accordingly, it is expected that in the proposed measure the agreement on this important practical matter will be reached in a harmonious and conciliatory manner between the interested parties. And when the agreement is thus reached, it will be authorized by the Government. When, however, the negotiation fails, the Government will make the decision. In both cases the Government will act not arbitrarily but in accordance with a certain definite standard and upon the recommendation of an appraisal commission composed of men with expert knowledge and practical experience selected from governmental and private circles. A provision is also being contemplated allowing civil action against an unsatisfactory decision.

All the electric power generated by the existing hydraulic generation equipment connected with the invested transmission equipment, will be purchased by the special company, and the rate of purchase will be decided on with the same careful procedure as in the case of the invested equipment appraisal, safeguarding the business interests of its owners. This measure will relieve institutions operating only in power generation of anxiety as to whether the whole of the generated power will be purchased. Consequently business conditions will be greatly stabilized. In the case of companies operating both in generation and transmission, the proposed measure will not react to their disadvantage, if power is purchased at the power plant at a price less transmission costs. In the case of companies whose operations cover the whole process of electrical undertakings from generation to distribution, they will be able to concentrate their business in the distribution of power by having access to power sources everywhere; they will be free from cares concerning generating and transmission finances and construction work.

As to the problem arising concomitantly from the transfer to the special company of the power equipment which is held in mortgage against the debentures, the question with reference to

debentures, especially foreign loans, which is likely to be raised with the execution of the control measure, will be settled in such a way as to respect the rights and interests of debenture holders and creditors. In respect to the material mortgage, ways will be provided in which the contents of floating mortgages will remain unchanged and valid even after the property representing those mortgages is invested, in accordance with the requirement of the new measure, in the proposed semi-official institution.

Furthermore, the Government is contemplating providing for means of causing the proposed company to be responsible for payment of the principals and interests of the debentures, and even guaranteeing or allowing the new company to guarantee payments. The Government is firmly convinced, in this connection, of the practicability of its appropriate measure for safeguarding the rights of the creditors and eliminating any sense of insecurity. In particular, with regard to foreign loans, as these involve the question of international good faith, the Government gives assurance that nothing contrary to that international principle will take place.

II.—PROCEDURE OF CONTROL

- (1) In carrying out the control measure, important matters relating to supply and demand, plans for the construction of the generating and transmission equipment shall be decided on by the Board of Electricity which will be created for this purpose. Issuing of instructions regarding power distribution and supply shall also be made by the Board.
- (2) The construction of equipment and the operation of business shall be executed by the special company to be created, in accordance with the decisions rendered by the aforementioned Board.
- (3) In order to ensure adequate and equitable functioning of the measure, all important matters shall be referred to the Electric Power Council for its recommendations. This Council shall be created with a membership including the best minds in official and private circles.

The purpose of State power control is, through close co-operation between the Government and the people, to effect the thoroughgoing and rational development and utilization of water power resources, the full and complete use of hydraulic and thermal generation, and the perfect and comprehensive improvement in utilization efficiency of the equipment in terms of national economy and defence. To achieve this purpose, it is thought advisable for the Government to assume responsibility in making decisions, on recommendation of the Electric Power Council, concerning basic matters in the operation of the industry—a measure which is also calculated to ensure the penetration of central control through the whole industry. On the other hand, it is considered advisable to leave the business aspects of operation of the industry in the hands of the special company which will promote energetic activity and economical management, thereby giving full scope to the initiative of private enterprise and to the economic advantage of the proposed system of Government-people collaboration. This participation by private interests in the enterprise will effectively eliminate the evils of pure governmental operation, while the complete control of important matters by the State will arrest any possible arbitrariness or selfish action on the part of the special company.

III.—SPECIAL COMPANY

- (1) The special company, of which mention has been made shall be rendered governmental facilities for raising funds and guaranteeing dividends, reduction of and exemption from taxes and other privileges necessary for business operation.
- (2) Officers of the Company shall be appointed by the Government; the creation of and changes in the articles of association, the issuing of debentures, the disposition of profits and other important matters shall be made with the approval of the Government; and orders necessary for supervision of the business of the Company shall be given by the Government.

Since the proposed special company is in the nature of a substitute institution taking partial charge of the execution of the national power policy, it is natural that the raising of the funds and

other facilities essential for the successful operation of business should be accorded, that the Governor and Vice-Governor of the company be appointed by the Government with Imperial sanction and the directors be selected from among the candidates, numbering twice as many as the directors, elected at the general meeting of the shareholders. As for the actual operation of business, however, this should be in the hands of an able and experienced staff so that full scope may be given to their initiative. The requirement of governmental approval, concerning the creation of and changes in the articles of association, the issuing of debentures, and the disposition of profits is intended to ensure the perfect execution of official supervision over the company. By these arrangements, it is felt that each party, whether governmental or private is safeguarded against falling into the evils of self-conceit.

IV.—POWER DISTRIBUTION BUSINESS

- (1) For the purpose of enlarging and strengthening the scope and extent of control of the distribution business in keeping with the State control of power generation and transmission, the rearrangement and co-ordination of areas for distribution shall be effected and the improvement of business conditions and the popularization of power utilization shall be promoted by the Government.
- (2) For the purpose of lowering and equalizing the rate of distribution in keeping with the price policy under State control, governmental supervision shall be augmented.

The power distribution business is by nature complicated and many-sided in its operations, being intimately associated with the daily life of the people, and has a greater element of business in its transactions and services than electrical undertakings as a whole. Furthermore, due to its local characteristics, it lacks the elements that would render its unified operation throughout the country technically and economically advantageous. Therefore it is considered advisable not to place it under State control, a consideration which is in accordance with the policy of making the effect on economic circles of the control measure as light as possible. It

is to be borne in mind, however, that without augmenting the control of this phase of electrical undertakings in correspondence with the basic policy of the rational and economic planning of power production and supply, the whole purpose of the national power policy cannot be achieved. Accordingly, a measure for effecting rearrangement and co-ordination of distribution areas, the levelling down of operation costs, the improvement of business conditions, and the standardization of the rate of distribution should be adopted along with one enforcing more adequate and effective supervision of distribution rates in keeping with the proposed rate policy under State control. Nor should the strengthening of the supervision in the direction of realizing the positive plans and undertakings for the wider and better utilization of electric power in the rural communities be neglected.

V.—POWER MOBILIZATION

- (1) A fair quantity of surplus power shall be stored at all times in preparation for emergencies and reserve equipment shall be properly arranged. As for the generation of power for private purposes, it shall also be subjected to control and co-ordination to a certain extent.
- (2) With a view to ensuring the supply of power and to meeting its immediate needs, the measure for control of consumption shall be carried out according to the requirements of circumstances.

In preparation for quick concentration of power in the places where it will be required during the time of large-scale national mobilization, transmission connections should be perfectly arranged; thermal generation equipment which is not in use in ordinary times on account of lower efficiency should be preserved for emergency purposes; and the generation equipment for private purposes should be connected in advance with principal transmission lines under State control. A measure for control of consumption should also be provided in order to complete the nation-wide preparations governing power supply in the time of emergency.

Mining and Heavy Industries in China

THE Department of Overseas Trade has issued a Report on Economic and Commercial Conditions in China,* by Sir Louis Beale, Commercial Counsellor at Shanghai, covering the period April, 1935-March, 1937. It should be noted that this report was written in May, 1937, before the development of recent events. Brief extracts from the Report are given below of those sections dealing with the mining and iron and steel industries.

Mining

China is believed to possess vast mineral resources, though any estimates of these resources must be regarded as problematical pending a thorough survey of the position. According to the latest estimate made by the Government Geological Survey, the coal reserve in China (excluding Manchuria, Mongolia and Turkistan) is about 238 billion tons, most of it in North China. Coal, iron, tin, antimony and tungsten are already mined on a large scale. Concessions granted by the Department of Mines for working gold, silver, copper, lead, zinc, manganese, molybdenum, salt, gypsum, barytes, arsenic, sulphur, fireclay, talc, asbestos, kaolin, mica, fluor spar, crystal, graphite and marble are also being exploited. Petroleum has been extracted in a small way for many years in certain districts of northwestern China. In addition, the Ministry of Industry itself holds the mining rights for important concessions for iron, tungsten, coal and petroleum.

The National Government's plans for industrial development are centred on the basic industries, including the production of coal, iron and steel, and petroleum. A number of joint mining enterprises have been operating in China, with varying degrees of success, for many years. Amongst the best known of these are the Kailan Mining Administration (the Chinese Engineering & Mining Company, Limited) in Hopei, the Chung Fu Corporation (the Pekin Syndicate) in Honan, and the Mentoukou Coal Mining Company near Peking,

which are all Sino-British partnerships for the production of coal. Other large and long-established joint enterprises in which foreign capital has been, or still is, invested are the Chinghsing Coal Mines in Hopei, the Chunghsing Colliery Company in Shantung, and the Liu Ho Kou Mining Company, Limited, in northern Honan.

A principal aim of Japanese policy in North China since 1935 has been the production of coal and iron ore in that area, and the construction of a new railway from Tientsin to tap the coal-bearing beds in Shansi, but so far no definite progress appears to have been made. The increasing demand for coal in Japan has also had a marked effect in improving prices, and lessening competition in the domestic market.

Coal

Coal has been extensively mined in China by modern methods for the past 30 years. Estimates of production vary widely, but according to published figures the output of coal in China proper was approximately 20½ million tons in 1934. Of this output about one-quarter normally comes from the Kailan mines in northern Hopei. The total consumption in China is estimated at approximately 20 million tons annually.

Many of the purely Chinese mines have been handicapped in the past by inept management, and also by lack of capital, which has prevented them from reducing costs by installing modern equipment, and necessitated cash sales to a restricted market. They have also suffered from the lack of deep harbors for the accommodation of large colliers. For these and other reasons, including banditry and uneconomic rail freights, they have hitherto found it difficult to compete either with imported coal or with the output of the Kailan and other semi-foreign mines in China. As a

*No. 678. H.M. Stationery Office, Adastral House, Kingsway, London, W.C.2. (Price 1s. 3d. net.)

result of the Mining Conference held at Nanking in June, 1933, a readjustment of freights and other measures to facilitate the transportation of coal were put into force, and towards the end of the year the competition of the native mines was already making itself felt. Their position was further improved by the increase of the import duties in 1934, and by the opening of the new harbor of Lien Yun Kang at the eastern extremity of the Lung Hai Railway. In the Shanghai market the output of the native mines has obtained a greatly increased share of the trade. The completion of the Chengyangkuan-Pengpu branch of the Tientsin-Pukow Railway, and of the Hwaiyuan-Yukikow Railway, has greatly facilitated the marketing of the output from the northern Anhwei coalfields, and the construction of the Nanchang-Pinghsiang extension of the new Chekiang-Kiangsi-Hunan Railway will open new markets to the mines in Kiangsi. The extension of the Tao-Ching Railway to provide more adequate transportation of the Chung Fu Corporation Honan coal was completed in 1936. A branch of the Cheng Tai Railway to carry the output of the Chinghsing Mine is now under construction.

The coal industry in China is being developed in accordance with the Four-Year Plan drawn up by the Ministry of Industry in 1935. According to this Plan, if in four years the three plants now being planned for making iron and steel are completed on schedule, the yearly consumption of coke will be 900,000 tons, equivalent to 1,600,000 tons of good bituminous or coking coal. In addition, there should be produced another 2,000,000 tons to replace the foreign coal imported into the Yangtze Valley and southern ports. Moreover, on completion of the Four-Year Plan, various industries along the Yangtze Valley will have been developed, and the coal consumption for industrial purposes will have increased yearly, possibly by over 1,000,000 tons. Thus, the Four-Year Plan of the Ministry aims at securing an increased yearly production of 5,000,000 tons of coal for all purposes, without, however, interfering with existing private collieries.

A National Coal Industry Conference, convened by the Ministry of Industries for the purpose of discussing ways and means to place the marketing of domestic coal on a co-operative basis, was held in Shanghai in June, 1936, at which the necessity of eliminating cut-throat competition among native coal companies and the checking of the dumping of foreign coal was stressed. In August, measures were approved for the formation of a National Coal Mining Joint Office to centralize control over production and sales. Private negotiations are also being carried on between the principal mine owners to fix prices and quotas for certain areas, and it is understood that some progress has been made.

Iron and Steel Industry

Iron ore in China proper is produced in large quantities only in the Yangtze Valley regions of Hupeh and Anhwei, and to some extent in Shansi. Important deposits are known to exist in the neighborhood of Tangtu, in Kiangsu, halfway between Nanking and Wuhu on the Yangtze. Export, which is almost entirely to Japan, is almost equally divided between Hankow and Wuhu. Exports of iron ore during the last three years have been as follow:—1934, 842,000 tons; 1935, 1,316,000 tons; 1936, 1,302,700 tons.

The iron smelting industry has been reduced to deplorable straits, and the total output of iron from Chinese furnaces annually amounts to less than 100,000 tons. The Yangtze Engineering Works at Hankow owned by the Liu Ho Kou Company, with a maximum daily capacity of about 100 tons, and the Yangchuan Smelting Works in Shansi with one 20-ton furnace, are the only works still in operation. The Hanyehping Company, which has six furnaces with a total capacity of 1,700 tons, has been entirely disorganized since 1928. The Lungyen Company's works at Shihchingshan, near Peking, built about 15 years ago, have never been in operation, though schemes for their opening as a Sino-Japanese enterprise were under discussion.

There has been a considerable increase in the number of workshops and foundries in China during the period under review, of which the most important is the Central Machine Works, to include an ironworks, steelworks, and machine works, now approaching completion. A German group has recently secured an order for a large iron and steel works to be erected at Chuchow, in Hunan, in an area which seems destined to become an important center of industry and communications. In April, 1937, a contract was signed with United Kingdom interests for the erection of a central

railway workshop, for repairing locomotives and rolling stock in the same area. In April, 1936, a United Kingdom firm of consulting engineers was engaged to report on the desirability of establishing an iron and steel works in Kwangtung, and a final decision as to proceeding with this enterprise is expected in the near future. There is a growing tendency on the part of foreign engineering firms towards partial manufacture in China, the finished product being assembled locally from imported special parts and locally-made simpler parts.

Tungsten

Tungsten is principally produced in Kiangsi but also in Kwangtung and Hunan. The output of ore in China represents over 60 per cent of the total world production, and almost the whole output is produced for export. China began to market tungsten ore on a large scale in 1918, in which year 10,000 tons were mined and 9,400 tons were exported. Between 1923 and 1928, exports as well as output decreased though over 7,000 tons were exported in 1926 and 1928: 1929 saw a revival with an export of nearly 9,000 tons, followed by another period of depression which reached its lowest ebb in 1932 when exports amounted only to 2,044 tons. Conditions improved again in 1933, when 5,252 tons were exported; export figures since that date have been as follow:—4,432 tons in 1934, 7,383 tons in 1935, 7,049 tons in 1936 and 4,646 tons in the first three months of 1937 (as against 1,613 tons in the same period in 1936). Until the revision of the United States import tariff in 1922, almost the whole China output went to that country, but the principal importer in recent years has been Germany, while large quantities have been shipped to Hongkong for re-export abroad. A considerable amount is, however, still exported to America, the United Kingdom, Sweden, France and Belgium.

A scheme by which tungsten ore from southern Kiangsi, the principal producing area, should be exclusively exported through a foreign agent at prices fixed by the Ministry of Industry, and by which the National Government would obtain a monopoly control of production and sales, was agreed upon in 1933, but eventually abandoned. In December, 1933, however, the Department of Reconstruction at Canton, through which the ore is normally exported, set up a Kwangtung Wolfram Monopoly from which permission to purchase and to export the ore has since been obtained. An object of both schemes was to eliminate speculative operations in the interests of the miners and others concerned in the trade. In 1935 the Kiangsi Provincial Government took over the control and operation of the provincial mines, and the sale, transportation and export of ore was confined to the provincial Tungsten Administration. Ore exported through Canton and Hongkong accounts for about 50 per cent of the total export. The remaining 50 per cent of the ore exported is controlled by the National Resources Commission of the Central Government at Nanking.

Central China Reconstruction

(Continued from page 92)

with the industrial machinery of Japan. In that respect, even greater thought should be exercised than in the case of Manchoukuo and North China.

First of all, industrial leaders of Japan should seriously consider which way Japan's industry should turn from now on and where improvement is most vitally needed. If for any reason Japanese industrialists hesitate to advance in Central China where the Japanese force have scored sweeping victories at great cost and brought about political stability, the Chinese or Occidental industrialists will surely take advantage of the situation at our expense.

China's problems are Japan's problems. How to shape and carry out our China policy should be the outstanding concern of the whole of Japan at the present moment. It is time that not only the government, but the entire nation considered definite steps regarding China in real earnest. It might be a good idea to establish a special national commission on China problems.

Positively under no circumstances should the Central China problems be considered as secondary to those of North China. Unless political stability is established and the foundation for economic activities is laid, the value of the successful war campaign is liable to be lessened, in which case anti-Japanism in China will not cease.

New Facts Concerning Soviet Oil Reserves

By Academician I. M. GUBKIN, Vice-President of the Academy of Sciences of the U.S.S.R.

(Reprinted from *The Mining Journal*).

AT the International Geological Congress, which took place in July, 1937, in Moscow, I made an attempt to calculate the reserves of oil in our country and gave figures which appeared to many as extremely bold. I said that the total reserves of oil in the U.S.S.R. amounted to 6,376.3 million tons, among which the proven reserves were 3,877.2 million tons. These figures aroused varied comment abroad.

At the same time, the foreign press was forced to admit that in volume of oil reserves the U.S.S.R. actually did occupy the world's first place. This refers to the category of proven reserves (to use American terminology), but if all our reserves were included, that is, geological reserves as well, then the prospects of our country as far as oil is concerned, are truly immense. We are only just beginning to approach the discovery of these reserves.

Though barely five months have elapsed since the International Geological Congress, yet the latest data concerning exploration and exploitation of the fields in Azerbaijan and other territories of the Soviet Union have led me to the conclusion that I was too cautious in my estimate of our oil reserves and that the figures I gave at the Congress must now be revised with a view to increasing them.

We will begin with the Baku region. On more than one occasion the question has cropped up of the exhaustion of old fields in the Apsheron Peninsula—Balakhany, Sabunchi, Ramany, etc. However, these show no inclination to become exhausted. According to calculations made by certain geologists in 1935, it would appear that all the high-yielding reserves would be exhausted by 1938, and only the low yielding layers would remain. However, the data of the last two years testify that within the limits of the Apsheron Peninsula, which supplies the country with tens of millions of tons of oil each year, there are reserves of an immensity one could not formerly have supposed to exist.

New prospects have been opened up in the old Ramany deposit, the structure of which is apparently like a fork, one prong running towards the Kalinsk deposit and the other towards the Surakhany deposit. And in the Surakhany deposit, too, new data have come to light. It is now supposed that the Surakhany structure is continued not only in the direction of Kara-Chukhur, but also in the direction of Gousan, that is, here, too, there may be a fork-shaped deposit.

Drilling at Zikh and on Peschany Island has revealed that these regions, too, contrary to prediction, are not becoming exhausted, but show a tendency to further growth. Even Bibi-Eibat, which was beginning to show signs of exhaustion, has revived and given new promise for the future.

Finally, there is Artem Island. How our conception of this field has changed! Not to mention the under-water section added to this field, our estimates of the amount of oil in the under-water zone along the coast in the neighborhood of Buzovny and Markakyany have greatly increased. Here a large structure has been found at the bottom of the sea, showing strong indications of oil. Thus, the question of the Apsheron Peninsula itself cannot at present be considered as finally solved. Notwithstanding all pessimistic prophecies, exploratory work here continually discloses new and tremendous prospects; the increase in oil-bearing fields amounts to hundreds of hectares, and hundreds of new production points.

In further development we shall start from the regions already industrially mastered, surround them with newly explored fields, and gradually enlarge our Soviet petroleum base in Azerbaijan to take in the whole of the Kura River valley.

Passing over other regions of the Transcaucasus, where there are not a few places of interest from the view of oil resources, such as Western Georgia, we shall proceed to the North Caucasus. By the North Caucasus I have in mind the Grozny Region. Daghestan, the Maikop and Kuban regions. Besides the new and promising wells of the Grozny fields, great interest attaches to the fields now

being worked in Dagestan—Kai-Kent, Achi-Su and Izberbash. There are grounds for believing that we shall discover a new oil field near Makhach-Kala; the near future will show.

Near Maikop in 1937 we obtained a number of new oil fields—at Asphalt Mountain, Kura-Tsetse ravine, Kutais, Shirokaya and Bezimennaya ravines. Thus we have a belt of oil deposits for a distance of 30 kilometers running north-west from Maikop. In 1936 Maikop produced a little over 3,000 tons of oil per day. During the last few months of 1937 Maikop was producing about 5,000 tons of oil per day. This is a large district which can and must produce much more.

At the present time considerable changes are taking place in the distribution of oil production in the Soviet Union. Up to the Revolution, Russia had one oil base—the Caucasus. During the period of the Second Five-Year Plan, a second oil base was created in the East of the Union. This base is growing from year to year, and its prospects grow greater every day. As recently as ten years ago it was strange to talk of Ural oil. People who attempted to raise this question were called either cranks or even by a harsher name—adventurers. But the facts showed that they were neither. In 1929 oil was obtained in the settlements on the Chusovaya River, and in 1932, a new oil deposit was discovered in the region of Ishimbayevo, near Sterlitamak. This region now yields nearly a million tons of oil a year. To the west of Ufa a new oil deposit was discovered—at Tuimazy, the wells of which yield from 100 to 150 tons of oil per day.

Special interest attaches to the discovery of an oil deposit near Buguruslan (Orenburg Province). The oil deposits found near Krasnokamski, Syzran and near Stavropol on the Volga, sketch the outlines of an immense oil area between the western slopes of the Urals and the Volga River. In the basin of the Kama River, on its left tributaries such as the Sheshma, and along the Sok, a left tributary of the Volga, there are a number of outcroppings of oil sandstones. In this class also belong Syukeyevo, on the right bank of the Volga, 100 kilometers below Kazan. These places are of great interest as future oil fields.

But we go farther and put the question thus: Have we not the right, by analogy with the United States of America, to count on meeting oil in other parts of our platform, within the limits of the so-called Russian ledge, in the central districts? Yes, we have such a right.

The Vyatka Uvaly (slopes) in the Vyatka River basin deserve much attention. At present, between Krasnokamsk and Kirov three projected parallel lines of exploration for oil are of undoubted interest. It is now particularly important to concentrate our attention precisely upon these central parts of the so-called Russian ledge—all the more so since we have been entrusted with the task of creating a fuel base for Leningrad and other northern points, that is, in the northern part of the Soviet Union.

The absolutely clear and definite traces of oil deposits discovered recently near the city of Romny in the Ukraine and near another point, situated somewhat more to the south, the Isachik cupola, need also to be mentioned. Here the task now resolves itself into uncovering commercial deposits of oil.

For lack of space I shall not dwell on the possibilities of increased oil production in Turkmenistan and other Central Asiatic Republics, nor in the Ural-Emba district, which now produces 466,000 tons of oil a year—an insignificant part of what it could be producing. I must refrain from speaking of the districts of West Siberia and other remote territories situated along the track of the Trans-Siberian Railway all the way to Kamchatka. New oil-bearing territories and individual fields of great promise are being discovered every year in these districts. We shall have to adopt the suggestion of Mr. L. M. Kaganovich, and seek oil, first of all, nearer home; afterwards we can turn our attention to places which are generally harder to develop.

(Continued on page 119)

Iron and Steel Expansion in Japan

BENJAMIN W. ASHMEAD, *Iron and Steel Section, Metals and Minerals Division, U.S. Commerce Reports*

COMPLETED by the Government in 1901, the Yawata Iron Works (Imperial Steel Works), Yawata, Fukuoka Prefecture, furnished the basis for the modern development of the Japanese iron and steel industry. By 1909 Japanese plants were equipped to produce—principally, structural shapes, merchant bars, plate, rails, and wire. At the outbreak of the World War, the rated annual capacity of the Yawata Works had been increased to 750,000 metric tons in sharp contrast with its 90,000-ton beginning in 1901.

Consumption of iron and steel in Japan had, prior to the World War, increased at a much higher rate than had local production, despite the addition of facilities at the Yawata Works and elsewhere from time to time. Hence Japan became an iron and steel import market of more than ordinary importance. However, in the 1914-18 period, sources of supply in both Europe and the United States were closed to a large extent, and as a result there was a marked expansion in Japanese productive facilities to meet the ever-mounting local consumption. Of the 43 Japanese iron and steel plants in existence at the end of 1918, the greater number had been established during the World War. Their individual annual capacities ranged from 5,000 tons of steel products upward. With the end of the war period, many of those producers were hard put to remain in business and did so only by sharp curtailment of output. Those units had been established when pig-iron prices, for example, were considerably out of line with those normally quoted. Another factor which affected them adversely was the competition from foreign-manufactured iron and steel items, so that by 1920 a number of the private firms were forced to discontinue business. However, despite the hard times encountered by the iron and steel industry as a whole during this period, the Yawata Works continued to expand.

It was not until 1925 (excepting the period from 1914 to 1918) that local production accounted for the greater proportion of the market for steel products than did importations. Out of a reported consumption of 1,570,000 metric tons in 1925, Japanese producers were able to supply about 1,000,000 tons, the remainder being imported.

Producers Hard Hit in 1930—Upturn in 1931

Japan removed its gold embargo in 1930. A very unfavorable reaction resulted with respect to the iron and steel industry. Local demand fell off sharply and promptly the market was literally flooded with imported products. Those plants which had been experiencing a period of expansion were forced to curtail operations drastically in order to exist. Thus the steady gain which had been made in the earlier years was temporarily halted. Japan reimposed the gold embargo in December 1931, and again the local industry strengthened, iron and steel consumption resumed its upward movement, and by the close of 1932 the output of steel products had risen to some 2,000,000 tons in registering an increase of about 300,000 tons over the 1931 total. Following those satisfactory results, definite plans were formulated to further increase the national productive capacity. By 1934, the steel-mill production level had been stepped up to over 3,000,000 tons—an increase of about 1,000,000 tons over the figure for 1929.

It was in September 1930 that plans were first drafted to merge all private and governmental iron and steel units with the Yawata Steel Works as the nucleus. When the time actually arrived to definitely place those plans into effect, prosperous conditions were prevailing throughout the industry. Many firms originally in favor of the proposal then considered it inexpedient to submit themselves to it. The result was that the merger (on January 28, 1934) involved only one governmental unit and six private plants. On that date those organizations were merged into the Japan Iron Manufacturing Co., Ltd. This company is now the largest one operating in the industry and has been described as overshadowing all "minor companies." Since the merger in 1934, the Japanese iron and steel industry has been moving forward at an exceptionally fast rate despite the problem of securing the necessary raw materials—coal, iron ore, and scrap—for its operation. Exports expanded rapidly—particularly those to Manchuria and

various other Far Eastern markets. Japanese products in limited tonnages found their way into South America, and small quantities were exported to the United States. A very high degree of competition was also apparent in the Philippine Islands.

Export Curtailment—Higher Rate of Imports

In 1937 Japan definitely curtailed its export trade in iron and steel products, because of the unusual local demand. At the same time the output of pig iron and steel ingots has been expanded, with an equivalent advance in rolling-mill production. Imports have likewise been following an upward trend—the United States benefiting to an important extent. In the few years preceding the present disturbances in the Far East, Japan had become practically self-sufficient in rolling-mill products, but with the unusual conditions now prevailing it has been found necessary to increasingly support domestic output with imported products—hence the record-breaking import trade which has prevailed throughout 1937. And, because of the demand in Europe for its own products, Japan has more and more turned to the United States instead of to Europe for those imports necessary to fill in where domestic output is deficient.

Effective April 15, 1937, Japan placed iron and steel imports on the "free list." Reports consulted appear to agree that the Japanese domestic industry could not be expanded at a sufficiently rapid rate to meet market requirements, and that as a result Japan would of necessity have to take steps to remedy the shortage of raw materials—hence the action taken to place iron and steel items on the "free list." The local Government now exercises very complete supervision over the local industry through the provisions of the iron industry control law. Import control is effected through the exchange control law. Building construction involving the use of steel has been virtually prohibited, the only exception being if the structure proposed is intended to house a necessary industry. Local prices are regulated through a system of sales cartels and by means of antiprofitteering laws. Early in 1937, the Government promulgated regulations requiring all dealers to report on stocks and purchases in order to better maintain price control.

Inadequate Supply of Iron Ore

Japanese iron ore deposits are described as "quite poor." Even when combined with ore from deposits in Chosen, it is not possible to produce quantities sufficient to supply the local blast furnaces. Consequently, it has been necessary to turn to outside sources for iron ore. In 1931 Japanese consumption requirements amounted to 2,175,000 tons, the 1936 figure having been estimated at 4,687,000 tons. In 1936, the estimated combined output in Japan and Chosen was only 907,000 tons. Japan plans to be in a position to produce 10,000,000 tons of iron and steel products in 1942. In order to produce the 8,000,000 tons of pig iron necessary to accomplish this, some 16,000,000 tons of iron ore will be needed. Present plans show that about 11,000,000 tons are scheduled to be obtained from Japan proper, China, Malaya, Australia, Chosen, and the Philippine Islands.

The Japanese iron and steel producing units are dependent upon scrap iron and steel to a very important degree—particularly in the absence of adequate iron ore reserves. In 1931, scrap consumption was about 1,112,000 tons and by 1934 had risen to 3,167,000 tons. In 1936, the total was reported at 3,045,292. A considerable part of the scrap utilized is imported and reports indicate that during the first seven months of 1937 those imports were approximately double the amount received in the corresponding period of 1936. Japan now has a joint association of six companies for the co-operative purchases of scrap iron and steel.

Dependence Upon Imported Pig Iron

Japanese has been dependent upon imported pig iron for many years. In the closing months of 1936, the pig iron situation locally was described as "acute." This was attributed chiefly to the delay in placing in operation plans which would permit a continual expansion in local output; pronouncedly higher quotations for scrap which caused a greater use of pig iron in relation to scrap;

(Continued on page 113)

Engineering Experience in China During the Last Two Decades*

By O. J. TODD, Secretary and Life Member of the Association of Chinese and American Engineers

THE excellent paper prepared by Professor C. A. Middleton Smith on "Engineering Development in China" for the July, 1937, issue of the *Journal of the Association of Chinese and American Engineers* inspires me to speak of some of my own conclusions to the engineering students and friends of Hongkong University in response to an invitation to contribute to the pages of the *Engineering Journal*. Realizing the wide interest in the matter of education of engineers and their subordinates in construction lines, I will give some of my impressions based on my eighteen years of China experience hoping to point the way of better preparation for the work that lies ahead of our profession in Eastern Asia.

As Professor Smith has well indicated, our profession needs organizations and publications in the Far East that will bring together the engineers of many nationalities that are working for the modernizing of China in ways that will greatly improve economic conditions. The Association of Chinese and American Engineers has been in existence less than two decades, yet it has become effective. It has so widened its scope as to be an international body welcoming members of every race and country. Its publications are issued in English so that many libraries both in Europe and America subscribe to its *Journal* and keep complete files for reference. In this way at least something is on record abroad, as well as in China, as to what our profession has been trying to do, and something as to its hopes and its ideals. It is chiefly through the contacts made in this Association that I have kept up my spirits when conditions seemed discouraging for our work, and it has been through the *Journal* of this Association that I have been able to record matters concerning my own engineering experiences in China. By reading this same publication from year to year I know something of the efforts and successes of my engineer contemporaries. It is our chief regret that so few of our engineers have written up for this or other engineering journals in English, reports or papers on the work they have been doing.

Every engineer should write occasional papers recording matters of interest to the public and the profession so that these may be published and read and kept in libraries as authentic statements regarding definite experiences that may have a bearing on future practice. In an article prepared for the August, 1937, issue of *Civil Engineering* of New York City on "The Progress of Irrigation in North China" I sought to show the construction methods employed and thus illustrate the contrast between labor conditions here and in America. In acknowledging receipt of my manuscript the editor of this magazine wrote me in part as follows:

"Our readers are not only interested in what is going on in China in engineering lines but also in the particular engineering or technical problems involved and the means that are utilized for overcoming them. I realize this particular interest as a result of your former contribution. That is, we are just as much interested if not more in the 'how' and particularly in the 'why' as we are in the 'what' of an engineering project. Your help in presenting these informative articles to our members is indeed appreciated."

The opinion of this editor is quoted that you may realize the engineering world is anxious to know what we are doing for our profession out here in China and how we do it. We should not be overreticent about describing work and methods that may seem to us quite primitive compared with the work of a machine-governed age in the Western countries. Eventually we, also, will employ machines where now we use men, but for the present we must realize that we have great economic problems to face and that the population problem of China with the low living standards that exist here makes us hesitate to recommend heavy investments in machinery at the present. We are in a period in which we must feel our way along. Surely these are days of transition. In writing of my work I have continually sought to explain why manual labor is used so extensively and why we build our structures in certain ways accommodating our plans to the life that we find here and the life that may exist for many years yet. For decades the contrast in living standards and wages will be marked as we consider engineering practice in China and in America.

My own work in China these past eighteen years has been in connection with laying out and building motor roads, irrigation projects and river-control structures. It has taken me into all the provinces of China, though North and Central China have been the scenes of my main activities. For the past twelve years or more I have traveled in China approximately 25,000 miles annually by train, coastal or river steamer, automobile, ricksha, Peking cart, mule litter, muleback, mountain chair, junk, bicycle and on foot. To this may be added one trip by aeroplane and none on camel back. The work of a civil engineer is usually active and takes him into all sorts of places and by all sorts of conveyance, the surest and most dependable being known as "shank's horses" or his own legs. To practice civil engineering in the field one must be able to walk and walk well, and without great fatigue.

Not all of this work has been suitably covered by published articles, but I have written on the three lines of engineering work that have been my chief interest, and also on education, on agriculture and once to pay tribute to a great engineer—the man who brought me to China but who passed away five years ago at the close of a brilliant career. To be able to tell my fellow engineers something of the greatness of this fellow member of our profession seemed quite as much my duty as to write of floods or irrigation work, so I wrote a short paper called "In Memoriam" in our *Journal* on that occasion. Also on returning two years ago after a short trip to America I wrote on some of the interesting engineering work I was privileged to visit in my native land making comparisons between America's and China's problems that confront the engineers.

It has been my great fortune to know rather intimately here in China and later through correspondence two very eminent engineers, each twenty-five years my senior. Both have been great workers in their special fields and both forceful men and prolific writers. I refer to the late Mr. John R. Freeman, a great hydraulic engineer, and Dr. J. A. L. Waddell, a famous bridge engineer. These men have both made their marks in the American engineering field. Their repeated advice to young engineers to record observations by means of published papers helped to encourage me to overcome the timidity that many feel toward commitments in writing.

My first introduction to China, in the fall of 1919 was in connection with studies of the old Grand Canal in Shantung. Here John R. Freeman brought me soon after my return from France and the World War. I was soon in the field, making studies for dams, reservoirs, and canals, working in bandit-ridden regions with numerous armed guards to protect our survey parties, and painfully gathering facts from a field of confusion where records of the sort we wanted were not to be found. I first heard of an "instrument bearer" that year and learned that young Chinese engineers did not climb trees to put up flags. Coolies did all this. I first heard of *feng shui* as known two decades ago and saw the marks of a very old civilization to which our technique was very new.

Our chief, Mr. John R. Freeman, believed in work—lots of it—and no one who expected to win his approval stood on ceremony. We went after our facts with all the strength we had and set a faster pace than had been customary in these lines in Shantung.

Then the great drought of 1920-21 came. The Grand Canal studies were brought to a close and the records locked in cases where they remain to this day. The famine that overtook five northern provinces in late 1920 called for suitably organized help. An immense program of public works was outlined by a group of Chinese and American engineers in Tientsin. Funds were not at hand to meet this \$25,000,000 scheme. But the American Red Cross decided to employ famine refugees on a rather broad road-building program in Shantung. It was to take charge of this work that I was called there in early March, 1921. The following month we had 35,000 workmen building earth motor roads in northern Shantung. By June 10 we had built 500 miles of pretty good motor road 20-ft. wide in the region north of the Yellow River both sides of the Tientsin-Pukow Railway. It had all been thrown up by hand and rammed down in thin layers by two man wooden tampers

* Reprinted from *Hongkong University Engineering Journal* for December, 1937.

made from old railway ties cut in two. This use of famine labor in Shantung and a similar program in Shansi, Hopei and North Honan gave the first great impetus to the good roads movement in China. Thus 1921 marked the beginning of a new epoch in road construction.

The following year while further road building was being carried on in Shantung, Yellow River dikes were also repaired under my direction with international funds used to give employment to famine labor. The local river bureau had lost out in its fight with the Yellow River west of Li Tsin in the autumn of 1921 and so the summer of 1922 saw the breach widened to such an extent that outside help had to be summoned. My plans and estimates for putting the river back into its bed were accepted that autumn and in December we began the work that was successfully completed the following spring. Here a combination of Chinese and foreign methods were employed to control this difficult river. A new American steam-operated piledriver was imported for the job and a ship load of long Oregon pine piling was brought in. To these were added all the 12-in. by 12-in. Oregon pine timbers 45-ft. or more in length that could be bought in the lumber markets of China. With four piles to the bent and the bents spaced 10-ft. apart, a trestle 800-ft. long was constructed with the piling driven 25-ft. into the riverbed. Meanwhile all available junks were bringing in stone from 100 miles or more up river until piles aggregating 40,000 cubic yards were accumulated. In April from this trestle the stone was dumped into the river onto a woven wire mesh mattress thus building up a rock-fill dam of pieces no larger than one man could lift. Men working day and night, transporting this stone by push car from the river bank across the trestle to various points along the dam that rose uniformly, soon completed the core of this structure. A cutoff channel had been dug to tap the river immediately above the new dam and lead the low-water flow 6,000-ft. to the old riverbed. The reversion of the river was accomplished and the new dam made watertight before summer. The entire work of channel excavation, dike construction, dam building, rock transport, etc., took a force that ran up to 25,000 men at the peak of the work. No such force of men is used in America on a project of this size, but here machinery was a small item compared with what was accomplished by hand labor. The ordinary foreign engineering staff would have found it difficult to work in this situation for it is taught to think in terms of machine labor for the most part.

This work of throwing the Yellow River back into its bed was carried out in the spring of 1923, yet in the spring of 1936, when I was again called in for a similar piece of work but in the capacity of consultant rather than chief engineer, I found my Chinese colleagues employing less machinery than I had used. They had no piles or piledriver but substituted "stone sausages" which they made of willow branches tied in small bundles by wire and these in turn formed the casing that held the stones or core of each "sausage" which was duly tied into a great loglike piece by numerous hemp ropes. Then the sausage was rolled into the river from the end of the breach and anchored in place. This method continued from the two sides until the breach was closed, it being confined, however, to the middle 130-ft. of the closure. The "contraction" method by use of kaoliang stalks and ropes had been used from the two ends until the current became too swift to go farther when the stone "sausages" were employed to finish the job. A detailed description of this last-mentioned piece of river work was published in the May, 1936, *Journal of the Association of Chinese and American Engineers*, the paper on this work being called "The Yellow River Dike Breaks of 1935."

So well pleased was the foreign group with the results of its donation of \$360,000 toward the Li Tsin reversion project (which cost a total of \$1,500,000, chiefly raised by the Shantung Government) that it decided to have its own Engineering Department to which I was invited as its chief. So from the autumn of 1923 for twelve years it was my privilege to work in many provinces in charge of work that was laid out by our own staff and carried to completion by funds partly from foreign and partly from local sources. With the growth of the National Economic Council this work was more and more taken up by the Government until the need for the service rendered by the China International Famine Relief Commission seemed to have passed and funds from America for such work practically ceased to come to China. But those twelve years of pioneer work aided in bringing in a better understanding of what Western engineering had to offer and how it could be made to adapt itself to local conditions found in China.

During those years with the Famine Commission I was able to play a part in helping give urgently needed help to the road-building programs of Yunnan and Kweichow back in 1926 and 1927 when we did not see a wheeled vehicle in the latter province. The trip from Yunnanfu to Kweiyang was made on foot, horseback or in mountain chairs taking three weeks for the journey. Hand labor was used entirely for the road building then done. Now these two western capitals are connected by motor roads with Shanghai and Nanking. Our work there, as in Shantung, was that of pioneers only, as we broke new ground, prepared specifications, furnished certain trained staff and helped give leadership in the beginning. My two trips into Kweichow from Yunnan in 1926 and 1927 were significant in that they helped to bring detailed reports on China's South-west to the nation's capital.

While working with this same China International Famine Relief Commission opportunity has come to me to study the Yangtze River in its lower stretches from Shasi to below Kiukiang. In the spring of 1925 we faced a difficult problem at Shihshow and solved it. The long line of main south dike just downstream from Temple Hill had been washed away by two successive floods and the farm lands to the south drowned, making farming almost impossible in three townships. In order to put in a dike that would hold we drove interlocking wooden sheet piling 14-ft. below the ground surface across a length of 2,000-ft. Back of this piling we excavated a ditch 10-ft. deep into which was packed carefully selected clay thus making a watertight core against seepage for there was much sand in the ground where these breaks had occurred. The main dike rose 25-ft. above the flats and was made as wide as 200-ft. at the base. Its river slope was well covered with good clay and on that was placed a heavy riprap facing. This work stood against all wave wash and current cutting. Engineer Stroebe of the Yangtze River Commission pronounced the work a model in dike work for the Yangtze.

Later, after the flood of 1931, we were again called to the Yangtze at Kiukiang and had a share in the program that was organized by the National Flood Relief Commission. But always our own work was under our staff's direction and a part, at least, of the costs came from foreign funds. In all of this Yangtze River work we employed the large stone flappers used by eight men and hammered down the earth in layers one foot in thickness. Shoddy work was not permitted. The inspection was rigid, and in consequence the work held.

Highway building engaged us particularly in Shensi and Kansu where we rebuilt many parts of the long trunk road from Sian to Lanchow, a distance of 480 miles, working on this from the spring of 1931 to 1934 and expending \$580,000 on grade improvements, bridges, etc. The seven most difficult hills including Liupan Shan had new grades laid out and built over them under my direction. All grades were reduced to seven per cent or less though previously grades up to 18 or 20 per cent existed. Everywhere we used hand labor and managed to get the earthwork done at an average of 35 cts. per *fang* of 115 cubic English feet. Rock-work cost us from 60 cts. to \$2 per *fang* on the famous Liupan Shan slopes. When our funds were exhausted and we turned this road over in the National Economic Council our program was 90 per cent completed. Autos could traverse the 480-mile route to Lanchow from Sian in 2½ days instead of spending eighteen days as in former times when mule carts were the ordinary means of conveyance. This and other road building in Shensi and elsewhere were constant witnesses to the fact that modern engineering practice did have something to offer to China and that cost need not be excessive where engineering efficiency is possible. Honesty, hard work and adaptability seemed the chief factors to be considered. The keeping down of overhead is one of the most important things to be considered here as elsewhere on public-utility enterprises.

Studies made in Shansi Province in 1933 and 1934 indicated that the Fen Ho might be improved at reasonable costs so that winter flow could be stored in reservoirs to supplement normal spring flow and thus increase the areas to be benefited by irrigation. These studies also showed that the floods that often occur on the Taiyuan plain may be averted by straightened channels properly protected by stonework with arrangements to take care of major flood flows between properly spaced outer dikes that would function only for a few days per year in time of extreme floods. Hydro-electric power development at Hu-kou Falls on the Yellow River on the west border of Shansi was investigated by our staff during this same period and a special report was printed similar in size

and appearance to that issued on Fen Ho Conservancy. These studies were joint undertakings wherein my own services were donated from America through the China International Famine Relief Commission and the main costs of the surveys were borne by the Shansi Government.

In irrigation work both at Saratsi in Suiyuan and in the Wei Pei district of Shensi the China International Famine Relief Commission invested large sums as donations to these projects, the work being laid out and handled under my own direction. The provinces benefited aided by grants of money and in other ways. The Saratsi Project was commenced as a famine-relief measure in the summer of 1929 and was never entirely completed due to lack of funds, though it has made possible the irrigation of 300,000 *mu* of land out of the 1,200,000 *mu* that eventually can be served. Our engineers were in charge for the first three years but the project was prematurely turned over to a mixed committee of non-technical men. For this reason the project has never been carried to completion nor been maintained properly. Let this be a warning to every engineer in China to urge the continued control by engineers of every public utility or other engineering project until it has functioned well for several years. In this instance the engineers were overruled by laymen. Here is a much neglected line of education. I refer to the job that our profession has ahead of it in convincing the layman, whether he be an official, a businessman or a missionary, that it is as dangerous to turn engineering projects prematurely over to non-engineering staff as it would be for doctors to turn hospitals over to the same sort of staff.

Better after effects have resulted from our work in the Wei Pei in Shensi where we built structures to revive and improve an old irrigation project that had long ago gone to ruin. From late 1930 to the summer of 1932 we were busy here putting in a good concrete diversion dam, driving a tunnel (using a portable air compressor to operate the drills due to bad water conditions), cutting a canal in solid rock on the mountain side for a mile and then through conglomerate in deep cutting to get the water out onto the plain. The bringing in of the air compressor meant introducing this machine into Shensi for the first time. Hand drilling is considered cheaper except in very wet places. Fortunately my engineer friend, Li Hsieh, has been in charge of Shensi irrigation matters for years and he undertook the building of the distribution system for this project and has managed to keep control of the scheme in his hands or in hands of engineers whom he has trained.

In consequence of the large benefits obtained as a result of our work on the Wei Pei Project, which has been functioning well and restored prosperity after the serious drought famine of 1929-31, three other irrigation projects have been built by the Shensi Water Bureau and all following the improved technique introduced at Wei Pei, making numerous improvements to the pioneer work we initiated. The paper referred to in *Civil Engineering* in the first part of this article tells of those irrigation projects in Shensi.

In these various projects with which I have had the good fortune to be connected, usually as chief engineer, hand labor has prevailed, Chinese staff not foreign-trained has been my main aid, and common labor has furnished the power as a rule. Peiyang University has furnished more men for my staff than any other engineering school. I have had a few foreign-trained engineers, one of whom was my chief assistant for years and is now chief engineer for the Whangpoo Conservancy in Shanghai. He almost entirely designed and built the Shih Lu Irrigation Project near Peiping and was an able office engineer handling matters for me while I was in the field. My memory of those years working with Chinese engineers will always be a pleasant one for we never had conceited men on our staff and we all knew that we were learning, pioneering and trying to graft a new technique onto an old world. In it all we lacked a link in the chain to which Professor Middleton Smith has referred—the trained artisan. Of this class there were always too few. In fact there were almost none at all.

Looking back over nearly two decades of active civil engineering practice in China I note that we must learn to adapt ourselves to circumstances, to work hard as leaders, to constantly balance new practice against old, to decide on the economics of the problem, and keep a school going day and night to train our subordinates in our ways and in the things they must do better than in the past if our plans are to be put into execution. We must use every device possible to get better artisans and encourage such men as Dean, Creighton and Gunn (all officers or past officers of the Association of Chinese and American Engineers) to carry on their work of training young Chinese to be better artisans, better foremen and

perhaps even designers of structures. In their North China School of Engineering Practice these men are doing in the line of architecture and practical construction on buildings what should be done by the Government in every principal city of China. Trade schools are needed if the work of the engineer is to go forward as it should. Our field of work for the future is wide and to carry out the large program that may soon confront us we will need men with trained hands as well as brains.

Then once more let us remember the layman. How shall he be taught? He has "face" and power and gets on committees and commissions and often helps make stupid decisions. Well, we must patiently and persistently drive ahead with our work of educating him. We may best do it through engineering organizations to learn teamwork and formulate plans. But constantly we must write for publications about our work and let the public know that we have a profession and that we are human. Not all that we write should go into technical articles for our own members alone to read. We must so put our material before the public that he who runs may read. We must cultivate a popular way of expressing our conclusions. In this respect the American Society of Civil Engineers has admirably succeeded in its comparatively recently inaugurated monthly publication called *Civil Engineering*. Writing for such publications as *Scientific American* should not be considered outside the province of the engineer. In fact it is through just such periodicals that our most intelligent and responsive public is found. I repeat again to all those of Hongkong University who may read this that it is the duty of all engineers to be educators in the broadest sense of that term. Acts and written articles are both mediums through which one's energies should be of the maximum value to his community and his country.

Iron and Steel Expansion in Japan

(Continued from page 110)

and a severe curtailment in pig iron imports from the Soviet Union. Consequently, Japan sought new sources from which to import pig iron, with the net result that important quantities of not only pig iron but also of steel ingots, blooms, etc., were purchased from the United States in the first 10 months of 1937.

In 1930, Japanese consumption of pig iron totaled 1,677,000 tons, of which 1,271,000 was met by the output in Japan proper and in Chosen, and 405,000 tons imported. In 1936, consumption was in excess of 3,000,000 tons with local production accounting for over 2,000,000 tons. Japan expects to be entirely independent of pig-iron imports by 1940, and reports consulted appear to agree that at the close of 1941 Japan hopes to be in a position to produce some 10,000,000 tons of pig iron.

The production of steel ingots and castings has expanded at a considerably more rapid rate than has that of pig iron. This largely accounts for the accelerated scrap movement into Japan. In 1931, production for Japan and Chosen totaled 1,883,000 tons, with a consumption of about 1,910,000 tons, the rest being imported. By 1934 production had reached in excess of 4,500,000 tons and consumption amounted to almost 4,000,000 tons. The 1936 production figure has been estimated at some 5,000,000 tons, and consumption at only a slightly higher figure. In 1937 and 1938 plans called for the completion of a number of new plants and the addition of facilities to current operations in order to step up the steel productive capacity.

Self-Sufficiency in Steel Mill Products

In 1935, Japanese statistics showed that exports of finished steel products exceeded imports, thus indicating that self-sufficiency in such materials had been attained, under normal conditions. However, a very large percentage of these exports went to the Kwantung Leased Territory, which, strictly speaking, represented colonial trade, rather than foreign trade. In 1931, local production accounted for about 1,600,000 tons for a consumption of about 1,800,000 tons, in 1934 the respective figures were 3,100,000 and 3,180,000 tons. In 1936, production was 4,300,000 tons against a consumption of 4,100,000.

Japanese imports of iron and steel have expanded sharply particularly since 1931. In that year the total was 998,000 tons, rising to 2,485,000 in 1934, to 3,200,000 in 1935, and then recording a decline to 2,900,000 in 1936. Imports in the first seven months of 1937 reached new heights and amounted to 2,460,000 tons, registering 972,000 tons more than in the corresponding months of 1936.

Special Concentration Process at Showa Steel Works, Anshan

(Contemporary Manchuria)

JUST as Fushun is world famous for its vast open-cut coal mines, so is Anshan equally known for its huge iron works which is not only the greatest in all Manchuria but one of the most modern equipped steel mills in the world. Iron is life to Anshan upon which depends the fate of this city. More than eighty per cent of the iron output in the country is there produced.

Located on the S.M.R. main line, Manchuria's "Pittsburgh," with its towering blast furnaces, is a relief to sore eyes after passing through Manchuria's endless plains on a monotonous five hours' journey northward from Dairen. The city itself, with its modern buildings, well kept streets and other up-to-date facilities, is a pleasant sight to perceive. A traveller visiting this thriving city with a population of 40,000, would no doubt be surprised at its rapid expansion if he were told that only twenty years ago, Anshan was merely a small hamlet surrounded by kaoliang fields. It is all to iron that Anshan owes its present state of development.

Iron deposits were discovered at Anshan only twenty-eight years ago. In August, 1909, Mr. Chutaro Kido, then director of the Geological Institute of the South Manchuria Railway Company, getting a hint from the name of a small hill called "Iron Mountain" (which is located west of Tangkangtzu Station), conducted a survey and found iron deposits there. The following year ten new iron mines—East Anshan, West Anshan, Takushan, Yingtaoyuan, Wangchiapaotzu, Kuanmenshan, Hsiaolingtzu, Paichiapaotzu, Hsinkuanmenshan, and Itanshan—lying within a semi-circle with a radius of 10 kilometers with Anshan as the center, were discovered. The total deposits of these mines are estimated at 600,000,000 metric tons.

Deposits of limestone, fire clay, silica and magnesite, which are indispensable in the manufacture of iron, were also discovered in the vicinity, greatly increasing the prospects for the inauguration of iron industry.

After laying out various plans, the South Manchuria Railway Company commenced construction of an iron works at Anshan in May, 1917. The first blast furnace was stoked on April 29, 1919, and pig iron initially produced on May 1.

Iron manufacturing in almost every case is accompanied by numerous economic obstacles. It was especially so with the Anshan Iron Works since it had to manufacture iron from ores of very poor quality. The decrease in the post-war demand for iron and steel and the resultant sharp fall in prices further dealt a severe blow upon the enterprise, so much so that the original plans had to be abandoned.

It was under such circumstances that experts of the Anshan Iron Works, in their diligent efforts to save the undertaking from complete failure, devoted their attention to the discovery of a process for utilizing profitably the lean Anshan ores.

Iron Ores as Material for Iron Manufacturing

The percentage of iron content in ore that is necessary for the smelting of iron is determined by the physical and chemical properties of the ore, topographical considerations of the mining districts, and marketing facilities. For example, in Sweden, ores containing more than 60 per cent of iron are generally used because of the difficulty of reducing the ores, due to their magnetic quality,

and the high cost of fuel. Up to twenty years ago, only ores analyzing above 60 per cent were mined in the Great Lakes districts, the United States, as they had to be transported over 2,000 kilometers to reach the smelters. As transportation facilities have been greatly improved since then, ores with even 50 per cent iron content are now being mined. In Great Britain, the Cleveland deposits, though containing only from 30 to 35 per cent of iron, are utilized profitably because they contain limestone, which is used in smelting.

Taking the above-mentioned factors into consideration, it is impossible to carry on the Anshan enterprise profitably unless ores analyzing above 50 per cent at the least are used. There are unfortunately very few deposits in the Anshan district which contain over 50 per cent of iron, the bulk of the deposits analyzing only between 35 and 40 per cent. Since the amount of comparatively rich ore is limited, it must be regarded that lean ores with less than 40 per cent iron content will ultimately have to be used. As the Anshan deposits, moreover, contain a large amount of silica which makes the smelting of iron difficult, it is necessary that some special process be devised to increase the content of iron artificially.

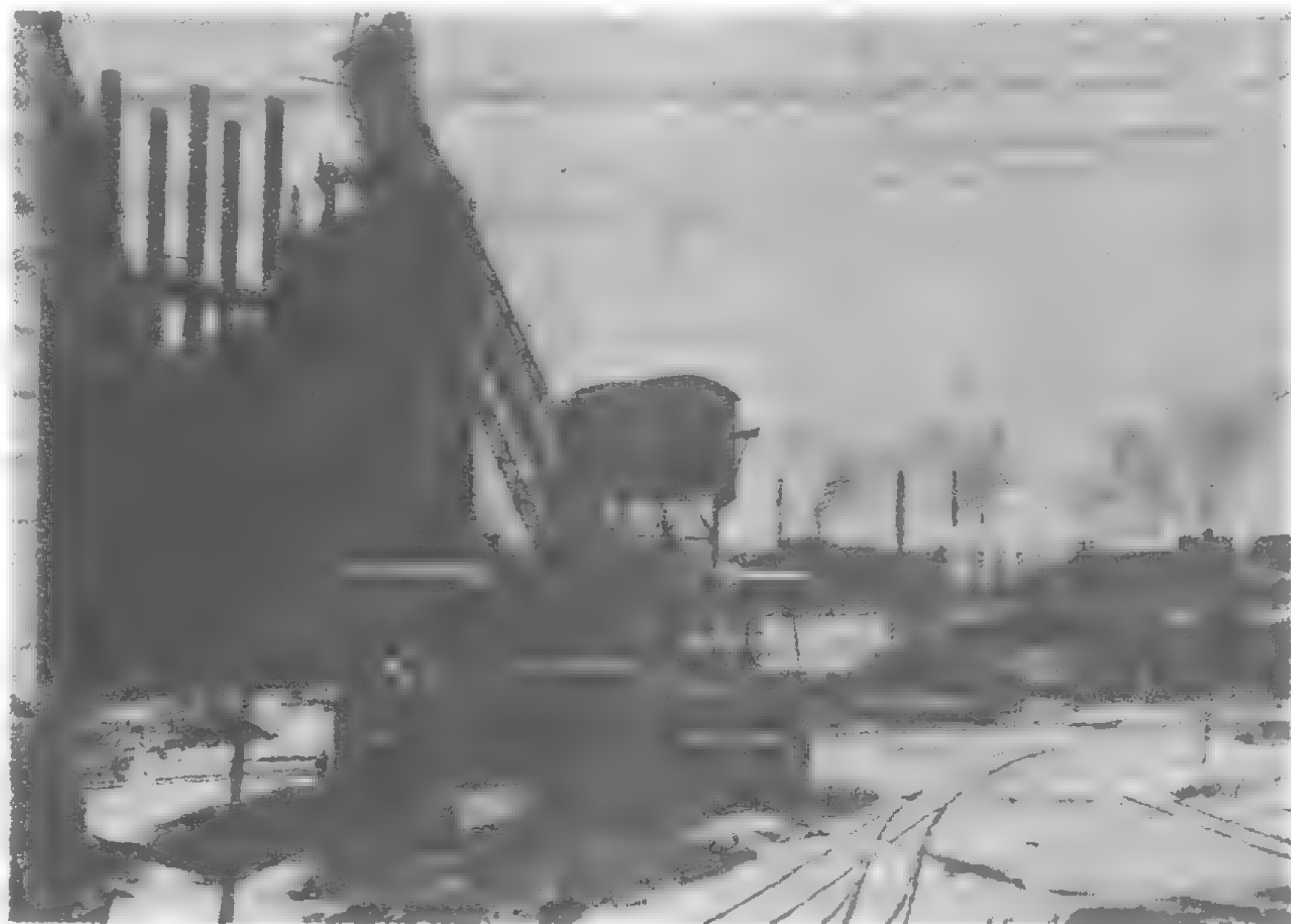
The term "benefication of lean ores" is used for increasing the iron content artificially by appropriate methods. For this, the following three processes are generally necessary.

(1) **Crushing process.** Crushing of ores to proper size.

(2) **Separation process.** There are various ways, but ordinarily, crushed ores are separated magnetically to obtain concentrates and tailings. The latter are discarded.

(3) **Sintering process.** As the fine concentrates, obtained by the above process, cannot be used for the manufacture of iron and steel as they are, certain process is necessary to form them into a solid mass. There are several processes, such as briquetting or sintering.

By the above processes artificial ore is obtained. In the case of the lean Anshan ores, however, the employment of these processes alone is insufficient to accomplish



Showa Steel Works, Anshan

the concentration purpose satisfactorily, owing to their following defects:

(1) Very fine particles of iron oxides are intermingled with silica, their size measuring less than 0.1 millimeter, and therefore it requires very fine grinding to effect a satisfactory separation.

(2) The ores are very hard and consequently difficult to pulverize.

(3) The ores are for the most part hematite and lack magnetic qualities, making it unsuitable for their industrial separation by the magnetic process.

Because of these defects, the employment of another process, in addition to those three previously mentioned, is necessary to beneficiate the lean Anshan ores. That is, before they are crushed, the ores must be roasted in a reducing furnace to be magnetized artificially, so as to make it possible to separate them by the magnetic process later. By the roasting process, the hard ores at the same time, become brittle and easy to crush.

This special process of magnetizing hematite ores at Anshan, discovered as the result of laborious and painstaking experiments, is an unprecedented attempt in the iron industrial world and has consequently commanded universal attention.

Beneficiation of Lean Anshan Ores

In the following paragraphs mention will be made on the various research made by experts of the Anshan Iron Works in their efforts to discover a process for profitable utilization of the lean Anshan ores.

As previously stated, the district around Anshan contains extensive deposits of iron, the bulk of which is of very poor quality, analyzing only between 35 and 40 per cent, and so the production was small compared with the large amount of fuel required, rendering the cost of production extremely high. Therefore, at first, only the comparatively rich ores with about 50 per cent iron content were mined, but as the quantity of such ore was limited, it became evident that even though only one furnace was operated, the supply would hardly last over three years.

In an effort to solve this problem, the South Manchuria Railway Company established a Temporary Research Department within the Anshan Iron Works in January, 1920, to conduct research regarding the beneficiation of the lean Anshan ores. The same year, the S.M.R. sent samples of Anshan ore to the Groendal Company in Sweden, and the Krupp and Humboldt Works in Germany, requesting them to devise a process for its profitable utilization and to draw up plans and estimates for the construction of a plant employing such a process should it prove successful. In June, the following year, the S.M.R. engaged the services of a party of six American experts, headed by the dean of the School of Mines and Metallurgy, University of Minnesota, to inspect the Anshan mining district and the work conducted by the above Department.

After the party returned home, a large amount of research materials were forwarded to the University of Minnesota, with the request that fundamental experiments necessary for the construction of an ore selection plant be conducted. Experts of the Anshan Iron Works were also sent to the University to assist research. Satisfactory results, however, were not obtained since the experiments only showed that out of the eleven mines around Anshan, only ores from Takushan could be industrially utilized by the magnetic separation process employed in America and Europe.

Though the desired results were not obtained at the University of Minnesota, Dr. Tsunesaburo Umene, then head of the above Research Department and at present a director of the Showa Steel Works, and his staff were not in the least disheartened and directed their investigations to the application of reducing-roasting of natural iron ore before subjecting it to the magnetic separation process. Their efforts were finally rewarded by the discovery of the special process which made it possible not only to conduct magnetic separation of magnetized hematite but also to make the hard ores brittle.

Following the discovery of the special process, the S.M.R. Company obtained a patent from the Japanese Government. In order to effect any improvements that might be necessary, a pilot mill was erected and operations conducted, with satisfactory results, brightly increasing the prospects for incorporating the new process. The industrialization of the process was finally assured as a result of further investigations made on the spot by technical experts called over from Japan.

Equipment for Beneficiation of Lean Ores

The most important equipment of the Anshan Iron Works is that for magnetizing hematite iron ore, which consists of charging, reducing and discharging apparatuses. The reducing furnace is rectangular, nine by two by six meters, with the exterior covered with steel plates and the interior lined with fire bricks. There are

23 such furnaces, each having a capacity of 300 metric tons per day. Each furnace is equipped with an exhaust fan for ventilation and elimination of combustion gas, with a capacity of 250 cubic meters per minute. Since the gas contains moisture and acids, the casing of the exhaust fan is made of cast iron, and the runner, of phosphorous bronze. The bottom of the furnace is water-sealed to prevent the oxidation of the roasted ores as well as to make the ores brittle.

Ores measuring about 100 millimeters are charged to the furnace from the top, and as they descend, they are roasted at a temperature of 600-700 degrees centigrade by flame entering the furnace from the combustion chamber which is heated by gas or pulverized coal. In the course of further descent, the ores are met by reducing gas rising from the bottom which perform reducing functions, changing the hematite to magnetite. The ores thus magnetized are pulverized by ball mills first and then by tube mills to a size less than 0.1 millimeter. The pulverized ores are then separated by the Groendal magnetic separator and concentrating tanks, and those containing about 60 per cent of iron are sintered by the Dweight Lloyd sintering machine to be used as raw material for the manufacture of iron.

The Anshan Iron Works at present has a capacity of producing annually 1,100,000 tons of sintered ore which comprise about 80 per cent of the total material used there for the manufacture of iron. This special process of reducing-roasting low grade ores is employed nowhere else except Anshan, and has consequently attracted world-wide attention. The United States and European countries have recently begun to study this new process, which is indeed a happy event in the history of the world's iron manufacturing industry.



Furnaces for reducing-roasting the lean Anshan ores; there are twenty-three such furnaces, each having a capacity of 300 metric tons per day

Establishment of the Showa Steel Works

The project for producing both pig iron and steel was already considered by the S.M.R. Company when the Anshan Iron Works was established in 1916. A plan aiming at the installation, by the end of 1931, of three furnaces and various other equipment for producing annually 400,000 metric tons of pig iron and 240,000 tons of steel, was drawn up by the Company, but was abandoned for a time owing to adverse changes in economic circles following the World War. It was later revived when the successful result of Anshan's iron concentration process and the decreased pig iron production cost ensured the profitable operation of the enterprise.

The plan, however, was again dropped for the time being owing to changes in the general situation, which necessitated a re-examination of the

basic iron policy. The S.M.R. Company in May, 1929, formally decided that it would be more profitable to erect the proposed plant at Shingishu, opposite Antung, and to maintain production of the Anshan Iron Works at 280,000 metric tons of pig iron.

The outbreak of the Manchurian Incident on September 18, 1931, revolutionized Japan-Manchuria relations and the need of inaugurating a steel manufacturing industry in Manchuria for the purpose of strengthening the iron and steel industry of Japan, came to be keenly felt.

In September, the following year, the S.M.R. Company reversed its decision and immediately commenced construction of the proposed steel plant at Anshan.

The Anshan Iron Works was reincorporated into the Showa Steel Works on June 1, 1933, the new corporation becoming an independent concern with a capitalization of Y.100,000,000.

The plan of the Showa Steel Works at the time of its establishment, aimed at the annual production of 400,000 tons of pig iron and 350,000 tons of steel. Production has since then jumped to 700,000 tons of pig iron and 500,000 tons of steel

(Continued on page 119)

Oil-Electric Trains for Ceylon

(From the Engineer, January 28, 1938)

HERE were recently completed at the English Electric Company's Preston Works the first four-car articulated streamlined oil-electric trains to be constructed in England. Built to the order of the Crown Agents for the Colonies, they are for operation on the Ceylon Government Railways, primarily on the Colombo-Matara section, which runs for the most part parallel to the sea coast, and at Colombo has stations at close intervals, serving a thickly populated suburban area. The design of the trains is the result of collaboration with the Crown Agents for the Colonies and the railway's chief mechanical engineer Mr. W. A. Smythe. Four lightweight articulated coaches form a normal train unit, made up of a power coach at each end, with two trailer coaches between them. The following are the leading particulars:—

Gauge	5-ft. 6-in.
Length over buffers	206-ft. 6-in.
Maximum width	9-ft. 10-in.
Seating capacity	300 passengers
Tare weight	94 tons
Weight loaded	116 tons
Wheel diameter	34-in.
Engines	Two 180 h.p. at 1,350 r.p.m.
Fuel tank capacity per engine ..	156 gallons
Maximum speed on level ..	55 m.p.h.

While the trailer coaches differ as regards passenger accommodation and electrical connections, the power coaches are identical and interchangeable. If desired, however, it is possible to remove one of the trailer coaches and to operate a train as a three-car unit. To reduce wind resistance and to give the trains an attractive appearance, they are streamlined. The gaps between the coaches are covered by bellows connections, which preserve the general body contour and help to reduce wind resistance. The body panels are also carried down below the floor level in the form of a skirting, which may easily be removed to allow access for maintenance to the bogies and running gear.

Accommodation is provided for seventeen first-class, forty-two second-class, and 241 third-class passengers, making 300 in all. The passenger compartments are of the "open" type, with seats on either side of a central gangway. In the first-class compartments there are "Alapax" seat frames. The seat cushions and squabs are of Dunlopillo, covered with moquette of attractive design. In the second and third-class compartments, shown in Figs. 1 and 2, the seat frames are of tubular construction, and the cushions have spring fillings and "Hairlok" squabs, covered with

"Rexine." A view of one of the first-class compartments is given. These trains, it is interesting to note, are the first in Ceylon to have upholstered seats in the third-class compartments.

Balanced lift-up windows and louvres, which can easily be operated, are fitted in all passenger compartments, and throughout the train there are parcel racks, "Monarch" ventilators, ventilating fans, and lighting fittings of modern design. A double coach roof enclosing a 2½-in. air space, and oscillating fans in the passenger compartments, serve to maintain a cool atmosphere. For each of the three classes of passengers lavatory accommodation is provided. The coach underframes are of fabricated plate girder construction, rigidly cross-braced and fitted with cantilever brackets to support the outer section of the body, which is integral with and welded to the underframe, so that the latter and body form a complete all-welded structure. On the exterior the body is panelled with copper-bearing, corrosion-resisting steel, welded to the body framing, which consists of pressed steel sections, giving ample strength combined with light weight.

The all-welded bogies are fitted with spring bolsters. Clasp type brakes are provided on all wheels. Lubrication to all working parts is supplied by grease guns applied to nipples grouped together in accessible positions. On each train the two outer bogies are standard traction type units, each carrying two nose-suspended axle-hung coach-ventilated traction motors, driving the axles through single-reduction spur gearing. Although similar in design to the driving bogies, the three articulated bogies do not carry traction motors. All the axles have "Skefko" roller bearing axle-boxes. The wheels are of the solid disc type, pressed on to the axles. There are buffers at each end of the train, and for use when two units are required to run as a complete train, there are automatic couplings. Normally, the buffers are not used, but are fitted to prevent damage in the event of other rolling stock being shunted into the train, which is also fitted with cow-catchers at each end.

Each power coach is divided into four compartments—the driver's cab (Fig. 3), engine and generator room, luggage compartment, and third-class passenger compartment. Panelled on the inside, roof, and partitions with sheet aluminium, the engine and generator room houses the main oil-engine generator set, together with auxiliary machinery and control gear.

The English Electric oil engine is directly coupled to the main generator with an overhung exciter. Mounted on an extension of the engine bed-plate the generator forms, with the engine, a self-contained unit, arranged for a resilient three-point mounting on the coach underframe. The three points of suspension



Fig. 1—Interior of Second-class Compartment



Fig. 2—Interior of Third-class Compartment

comprise a special spherical mounting at the front of the engine and trunnion mountings at each side of the main generator, a form of mounting designed to eliminate the danger of possible distortion of the bed-plate owing to flexing of the coach underframe. The additional resilient pads incorporated in the mounting pedestals also relieve the engine of road shocks which might otherwise be transmitted from the underframe when the train is running and serve to prevent engine vibration being transmitted to other parts of the coach.

The traction direct-injection, four-stroke, single-acting, cold-starting oil engine has six cylinders, with 6-in. bore and 8-in. stroke, and is capable of developing 200 b.h.p. continuously at 1,500 r.p.m., although for normal service on the Ceylon railways, the engines are set to develop a continuous output of 180 b.h.p. at 1,350 r.p.m., or a total of 360 b.h.p. for a four-car unit. The cast steel bed-plate forms the lubricating oil sump and is fitted with cross members which carry the housings for the main crankshaft bearings. The upper half of the cast iron crank case mounted on the bed-plate incorporates the cooling water jackets and the lower half is fitted with inspection doors to provide access to the main and big-end bearings. Inspection doors are also provided to give access to the cam shaft. "Wet" removable cylinder liners of special cast iron are fitted. Separate cast iron cylinder covers with air and exhaust valves, fuel injector, and valve rocker gear are provided for each cylinder, which has two exhaust and two air inlet valves operated by the cam shaft by push rods through the rocker gear.

All the valve-operating gear is enclosed in easily removable cast aluminium covers. Made of heat-treated aluminium alloy, the pistons are fitted with three pressure rings and two oil scraper rings. The gudgeon pins are of the floating type. The connecting-rods are drop forgings, with phosphor bronze small end bushes, and white metal big-end bearings. With the crank pins bored for lightness, the solid forged crankshaft, machined all over, is carried in seven main bearings, and at the generator end carries a fly-wheel and coupling bolted to one end of the generator shaft. At the fly-wheel end of the engine, various auxiliary shafts, such as the cam shaft, fuel pump, and governor shaft, are chain driven from the crankshaft. The C.A.V.-Bosch combined fuel pumps and governor and fuel transfer pumps are mounted on one side of

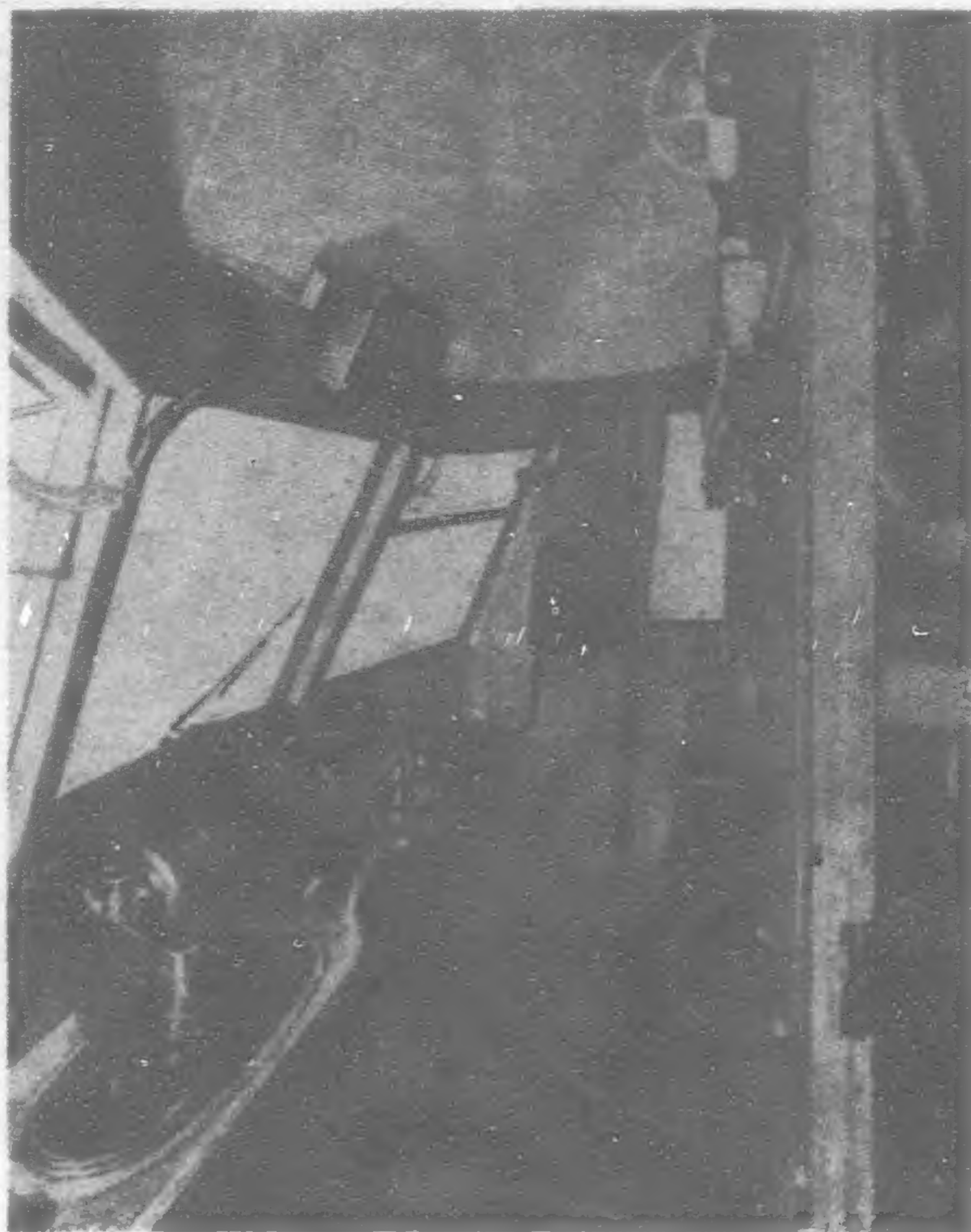


Fig. 3—Driver's Compartment

the engine. Three governor speed settings are provided—580, 900, and 1,350 r.p.m. respectively—and are obtained by oil-operated pistons. Admission of oil to the pistons is under the control of solenoid-operated valves, controlled in turn by the master controller in the driver's cab.

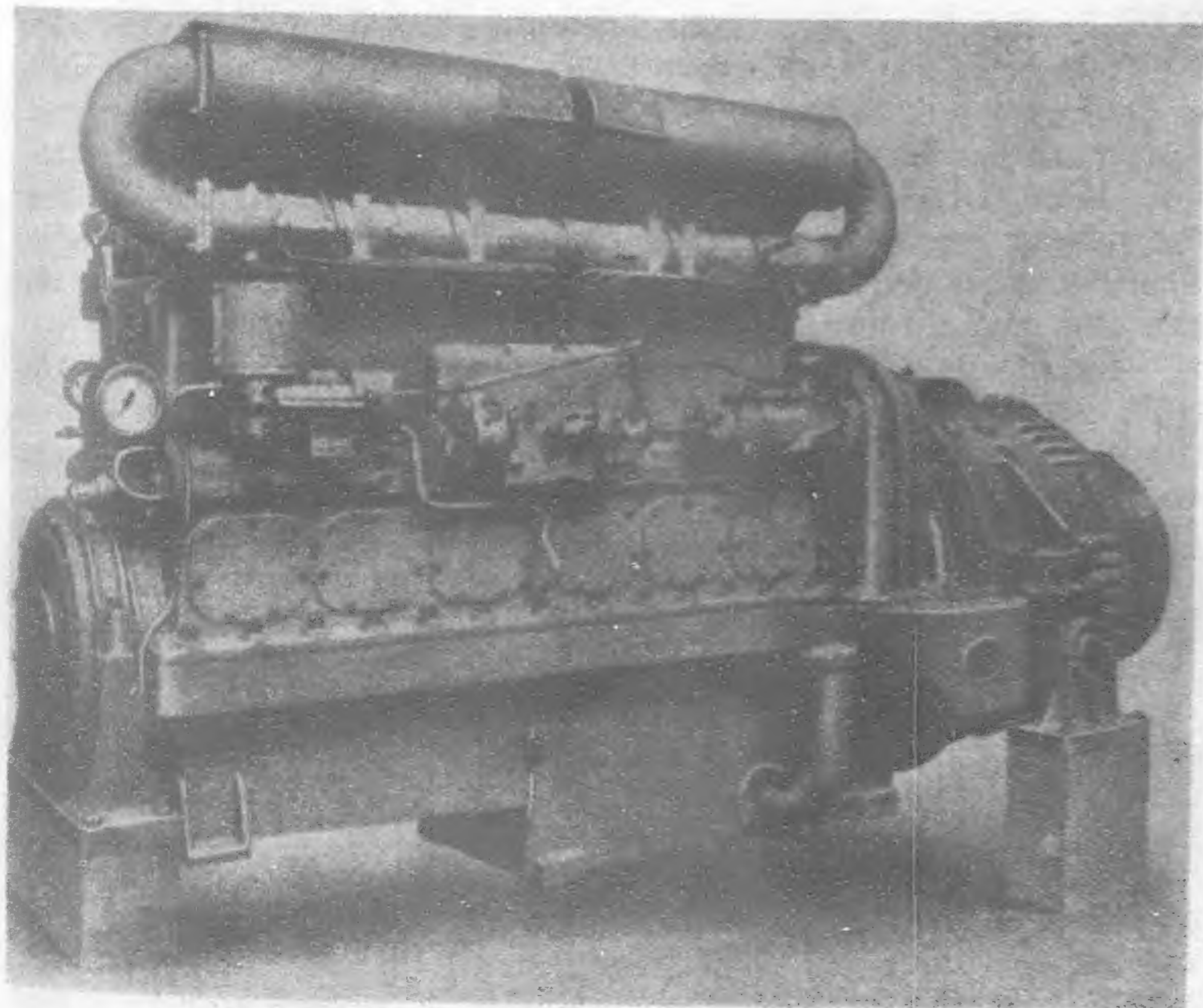
Fuel oil is stored in the main tanks on the coach underframe, and is pumped by the oil transfer pump via twin filters to the fuel pumps, and thence to the injectors. An emergency fuel tank on the engine-room roof is brought into use in the event of failure of the fuel transfer pump and feed fuel by gravity to the filters and fuel pumps.

Engine lubricating oil is stored in the engine bed-plate sump, containing a pump driven by a chain from the crankshaft. Oil is fed by this pump to the crankshaft main bearings, cam shaft bearings, and valve gear via the oil cooler and a filter, returning thence to the bed-plate. Lubrication of the big-end bearings is effected by forcing the oil from the main bearings through drilled passages on the crankshaft, while the small-end bearings and pistons are splash and mist lubricated. An electrically

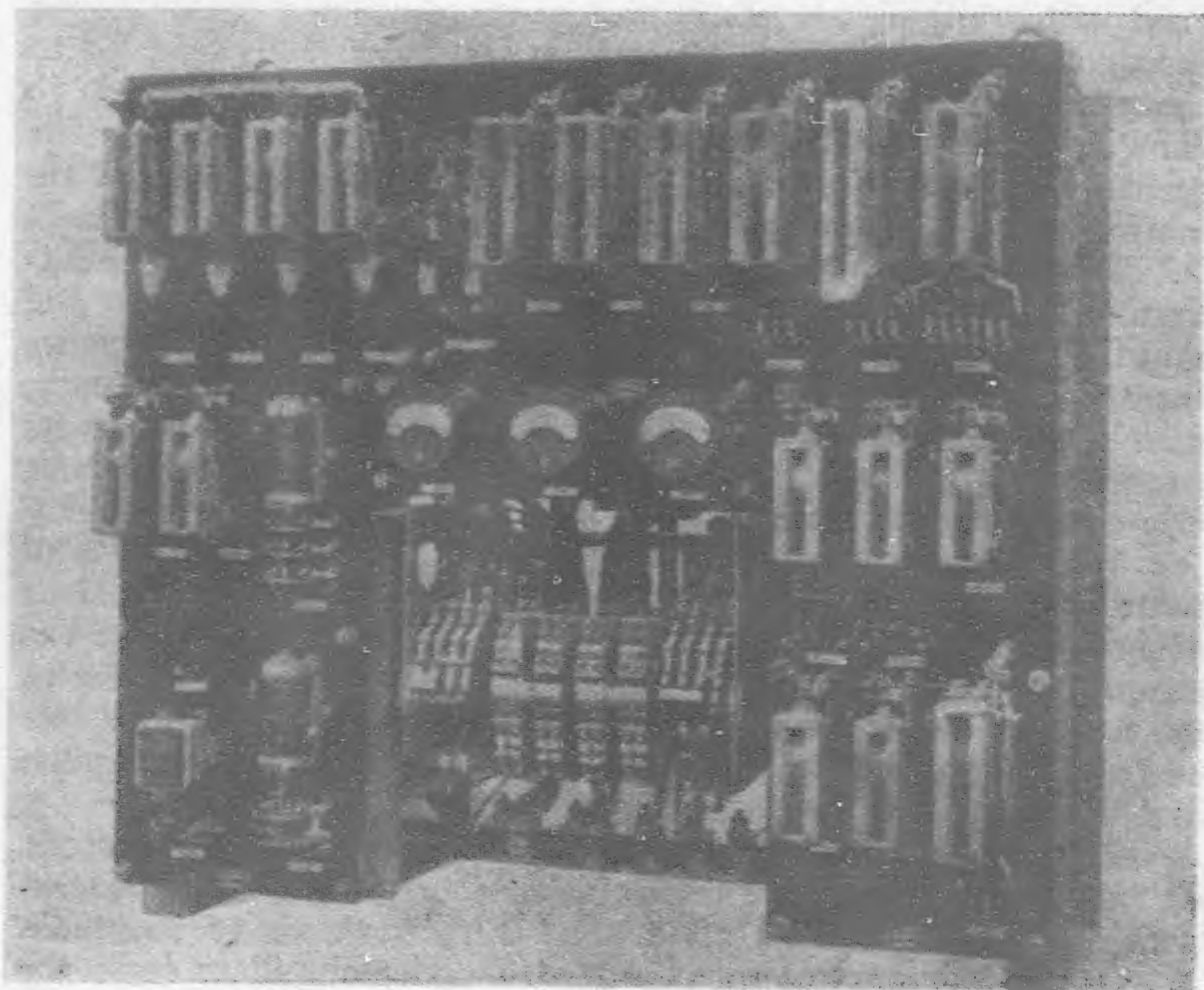
driven pump on the floor alongside the main generator is used to supply oil to the bearings before starting the engine, and an oil pressure-operated switch ensures that the engine cannot be set in motion until this electrically driven pump has built up the oil pressure to a predetermined value. For emergency use a manually operated pump is provided.

Engine cooling is maintained by water circulated through the cylinder jackets and radiator by a pump driven from the engine. The tubular radiator, made by the Spiral Tube Company, is mounted on one side of the engine-room and contains, as already indicated, oil and water elements which can be removed separately. Belt driven from an electric motor mounted on the engine-room floor, the radiator fan draws air from the engine-room and expels it outwards through the radiator. As the air is drawn in through louvres in the side of the engine-room opposite the radiator, and also from the main generator, adequate ventilation is secured.

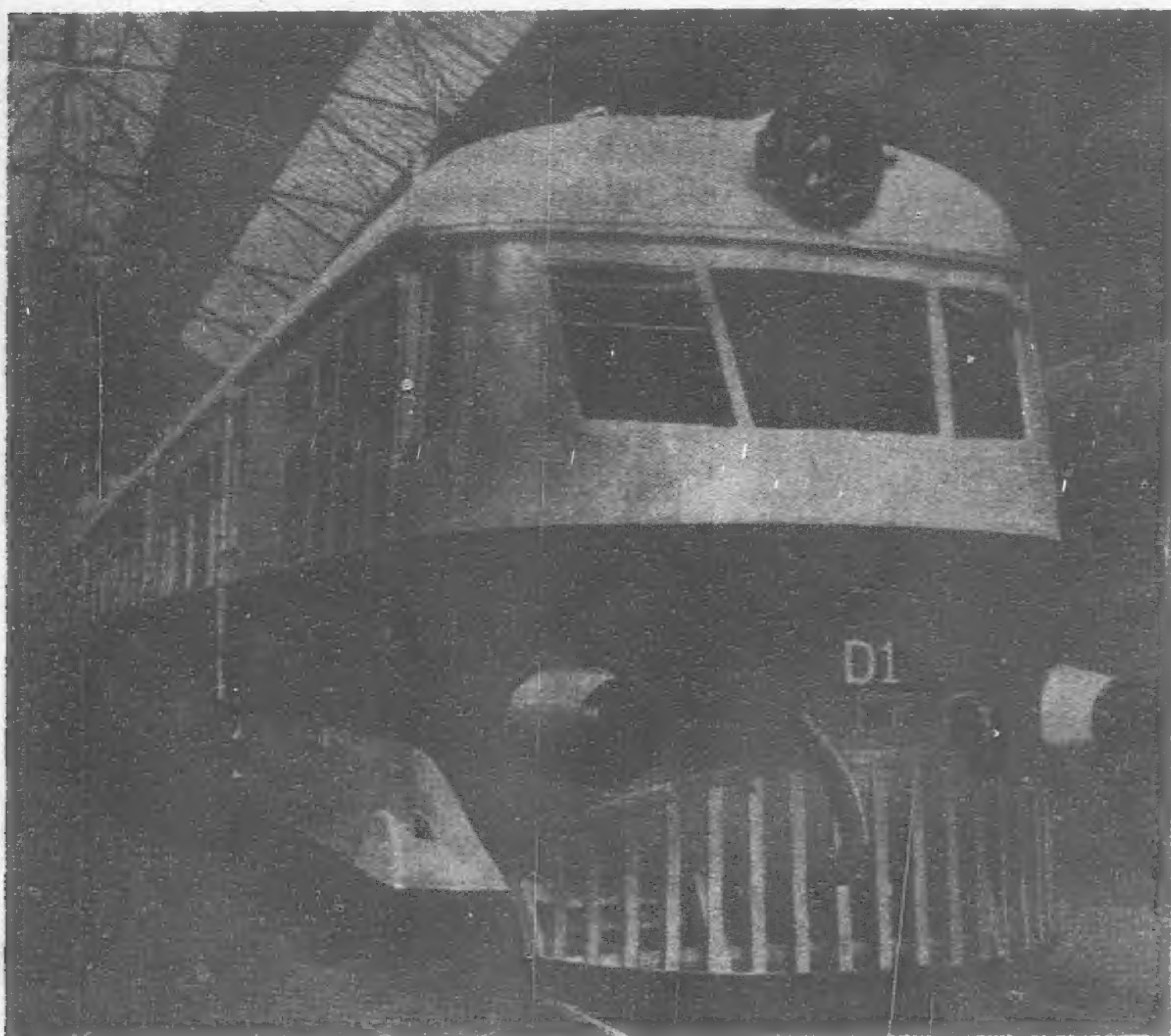
A partition divides the engine-room into two compartments, and the engine, radiator, etc., are in one compartment and the generator, exciter control gear, and battery in the other. A door in the partition allows a free passage through the engine-room, but normally it is kept closed and air flows through the louvres in the



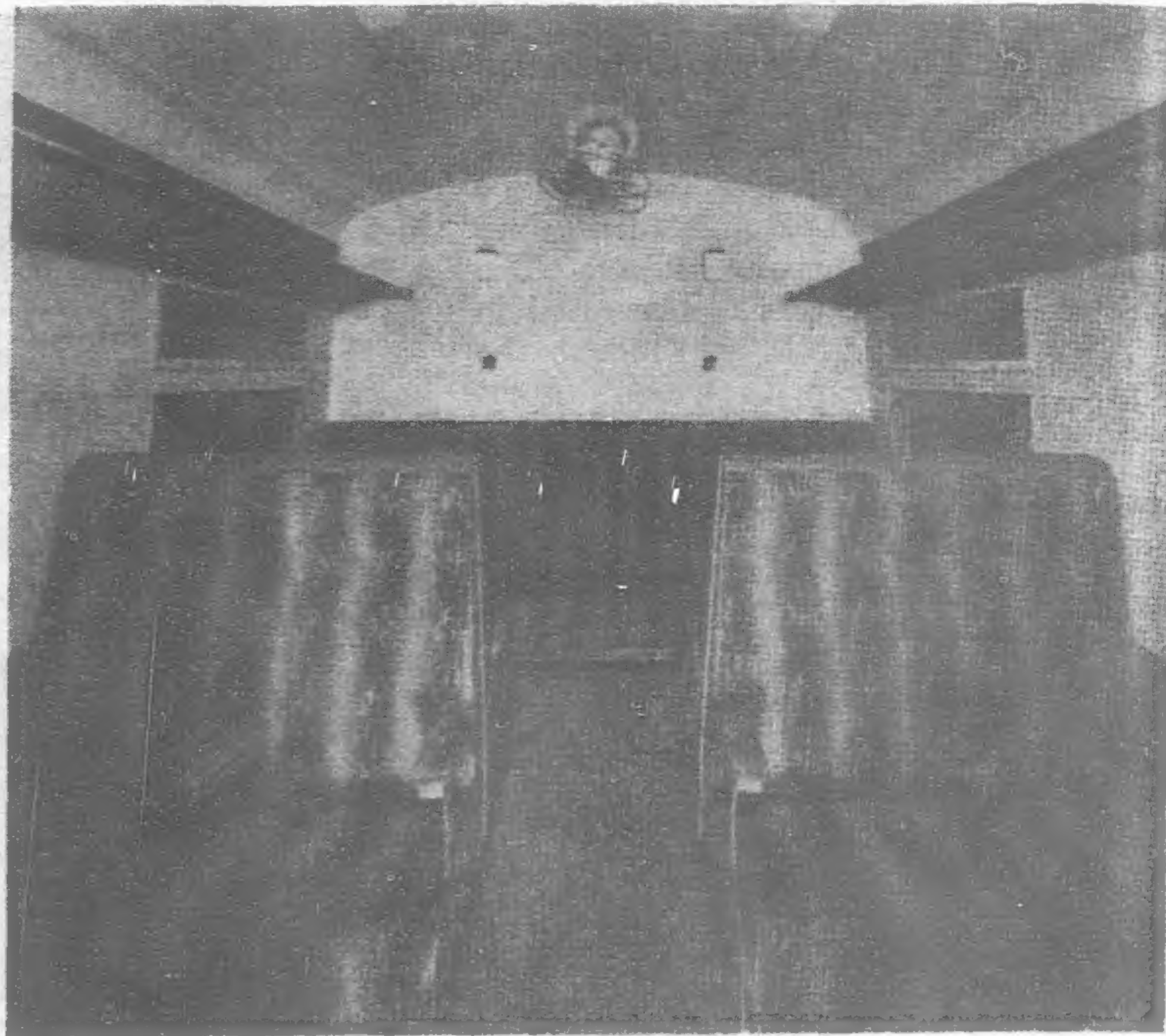
180 B.H.P. Oil Engine Generator Unit



Control Frame



Front View of Completed Train



Interior of First-class Compartment

generator compartment and through the exciter and main generator into the engine compartment. Air for the engine is taken from the engine-room through filters and silencers, whilst the exhaust is led to atmosphere through a dome-shaped silencer mounted on the roof.

The six-pole main generator has a separately excited shunt field winding and a series decompounding field winding. It is a single bearing machine with a roller bearing at the commutator end. At the other the armature is directly coupled to the crankshaft so that the weight of the armature is taken at this end by the last main engine bearing. The machine is specially designed for traction service and is self-ventilated. Its continuous rating is 120 kw., and the maximum voltage 500. The maximum current is 600 amperes. The combined effect of the shunt field and series decompounding field is to give a drooping characteristic, and the strength of the shunt field is permanently adjusted so that the engine cannot be overloaded on any of the three running speeds throughout the range of current and voltage over which the generator is designed to operate.

The two traction motors mounted on the bogie below the engine-room and supplied by the main generator are English Electric four-pole series-wound, nose-suspended, axle-hung, roller-bearing traction machines with a one hour rating of 112 h.p., and drive the axles through single-reduction spur gearing. The suspension bearings are of the sleeve type fitted with bronze bushes lined with white-metal. Both motors are ventilated by air drawn through a louvred inlet in the side of the coach body and led to the motors through steel ducts with a final bellows connection to allow for the vertical and lateral movements of the bogie. The carbon chrome steel gears are enclosed in a steel gear case and are lubricated with heavy-grade grease.

The overhung four-pole, 7.5 kw., 75-volt exciter is a shunt-wound machine, and performs several duties. It excites the shunt field of the main generator, charges the battery, supplies current for the control apparatus, lighting and auxiliary machinery, with the exception of the radiator fan motor, which obtains its power, from the main generator, which, under certain conditions, also charges the battery.

With a capacity of 161 ampere-hours the battery consists of twenty-four Exide Ironclad lead-acid cells divided into two sections of twelve cells, housed in separate containers on each side of the generator compartment. Its chief purpose is to supply power to the main generator for starting the engine when the generator acts as a series motor. It also supplies the control and lighting circuits and auxiliary machinery when the engine is not running.

The control switchgear comprises electro-magnetic contactors, a reverser, relays, knife switches, fuses, etc., mounted on bakelised-paper panels, supported on a steel framework above the main generator. The framework is carried on steel pillars from the engine-room floor. To make it possible to remove equipment from

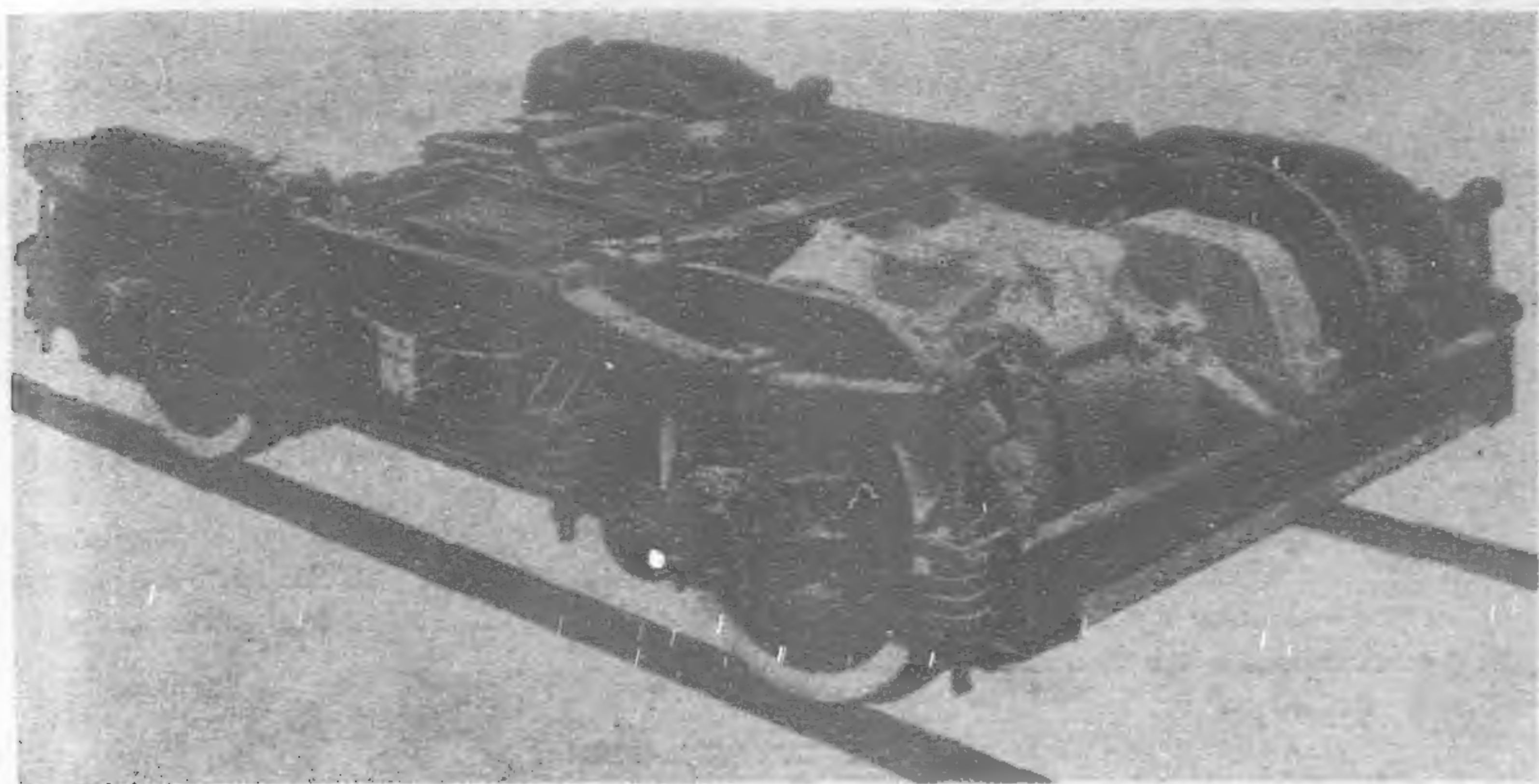
the engine-room a portion of the roof is removable, enabling the control frame to be lifted bodily from the coach, when the complete power unit may be removed.

To ensure maximum convenience and accessibility for maintenance purposes, the driver's cabs at each end of the four-coach unit have been carefully planned. The driver's control apparatus is in a "knee hole" desk extending across the cab width, and the driver sits in a central position at this desk. On the left is the master controller which controls the speed of the engine and train and determines the direction of running. On the right is the vacuum brake handle, and between these is the switch for operating the window wiper and the siren push-button switch. On the sloping part of the desk are the vacuum brake gauge, main generator ammeter, and headlamp switch, and all instruments are indirectly illuminated. A case containing four "engine running" indicator lamps is mounted just above the center front window, and each of these lamps is controlled by a switch on the engine. Thus the driver can tell at a glance which engines in the train (four in all when two trains are operating in multiple) are running. On the right-hand side of the cab at one end of the train is an indirectly illuminated "Stone-Deuta" speed indicator, and at the opposite end a combined speed indicator and recorder.

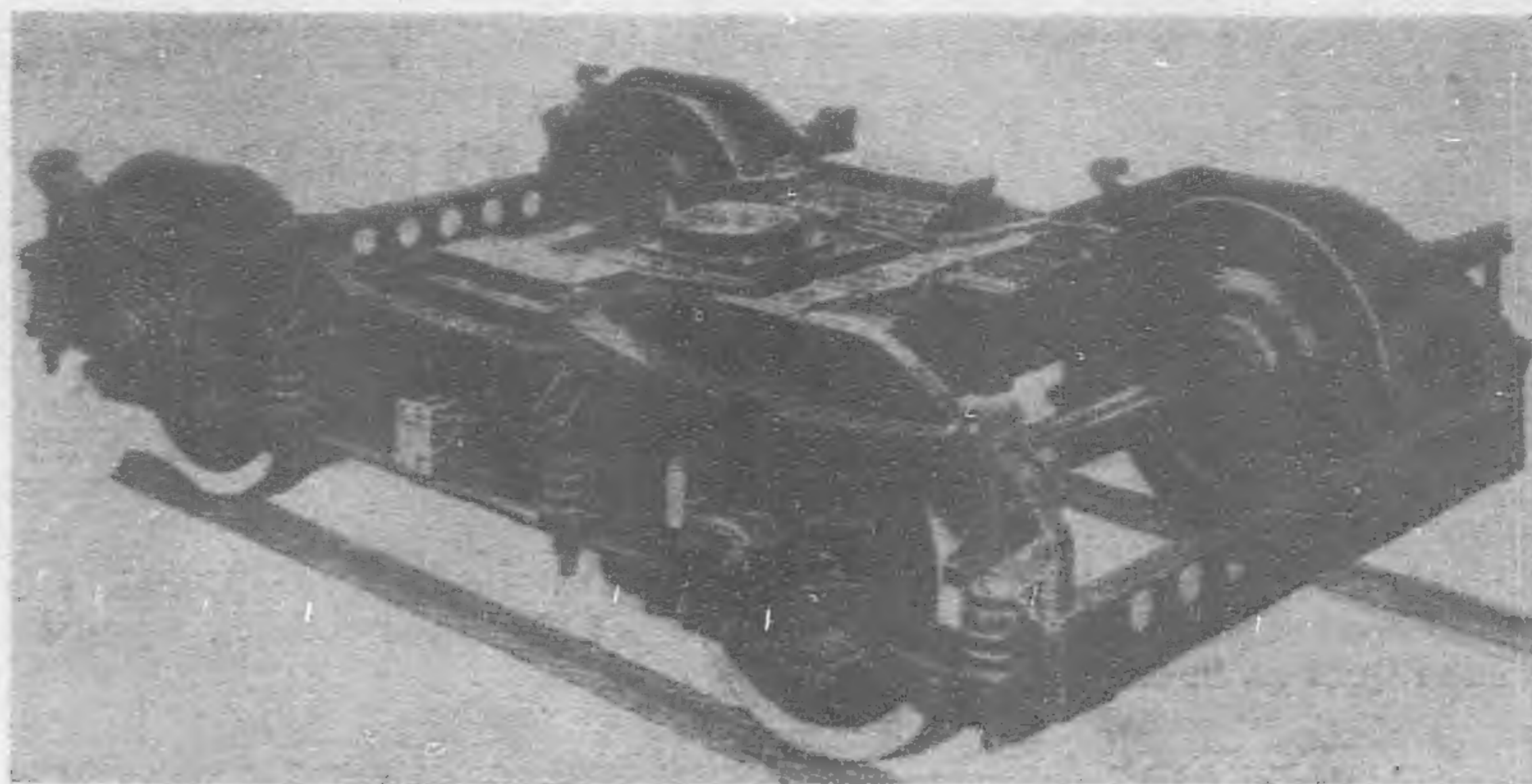
The control system is arranged so that the power units at each end of the train are under the complete control of the driver in the front cab. Control train line cables and jumpers run through the train length and when two trains are running in multiple unit, all four power equipments are under the control at the front end. Four control handles are used—the engine starting switch in the knee hole of the desk, the reverse key on the master controller, the master controller main handle, and the brake valve handle. There is also a control circuit breaker on the partition between the cab and engine-room.

By means of the engine starting switch, all engines in the train can be started up simultaneously. On depressing this switch the electrically driven oil pump is started up from the battery and builds up pressure in the lubricating oil system. When the pressure reaches 14 lb. per square inch, an oil pressure operated switch closes and enables the main generator to motor the engine from the battery. As soon as all the engines fire and run up to idling speed (as indicated by the lamps in the cab), the starting switch is released and closes down the oil pump motor. A separate switch is provided in the engine-room for use if only one engine is required to be started for testing, etc. The reverse drum of the master controller has four positions—"off," "engine only," "forward," and "reverse." In the "engine only" position the engines may be run up to full speed for testing purposes without moving the train or exciting the generators.

To prepare for starting the train, the reverse key is moved to the forward or reverse position, according to the direction in



Motor Bogie



Articulated Bogie

which it is desired to travel, and with the master controller handle in the "off" position, the engines run at idling speed. This handle has five operating notches and on the first the train is operated with the engines running at the lowest speed. On the second and third notches the engine speed and output are increased, with consequent increases in the train speed, and on all these notches the traction motors are connected in series across the main generator. On the fourth notch the motors are reconnected in parallel across the generator to obtain increased train speed, while a further increase is obtained on the last notch by shunting the traction motor fields through resistances. When the controller handle is moved back to any of the first three notches, the parallel and field shunt connections of the motors are retained, thus allowing the train speed to be maintained at a lower engine speed. The master controller has a deadman's handle, and a deadman's pedal, which may be used on long runs to keep the handle depressed if the driver desires to relax pressure on the handle, but both handle and pedal have to be released to operate the emergency device. The action of releasing the handle and pedal cuts off power to the traction motors, reduces the engine speed to idling speed and applies the brakes.

The automatic brakes are under the control of the driver's brake valve. A Westinghouse motor-driven reciprocating two-speed exhaustor in each engine-room normally runs at low speed to maintain vacuum in the brake system, but when the brake handle is moved to the "release" position the exhaustor is run up to higher speed to obtain a quick release of the brake. Emergency cocks connected to the brake system are provided in the passenger compartments and there is a screw-down hand brake, operating on the wheels of the driving bogie in each cab.

To guard against damage to the equipment, there are various safety devices. An oil pressure switch incorporated in the engine lubricating system automatically stops the engine in the event of the oil pressure falling below a safe limit. Similarly, a water thermostat stops the engine if the cooling water temperature rises to an excessive value. Oil and water thermostats are also arranged

in the respective systems for controlling the radiator fan motor. Another safety device is an emergency over-speed engine governor, which, if operated, cuts off the supply to the fuel pumps. Besides the instruments mentioned in the cab, there are certain other meters and gauges in the engine-room, including a main generator voltmeter, exciter ammeter and voltmeter, oil pressure gauge, oil and water thermometers, an engine tachometer, and a "Servis" engine running and train running recorder.

Train lighting is supplied from the exciter and battery. Lights and fans in the passenger compartments are under the remote control of master switches in the driver's cabs, and individual switches in the fan circuits are also provided in the passenger compartments. Above the entrance doors of these compartments are illuminated "roller blind" destination indicators and embarkation lights. The latter are controlled by switches in the cab, and are used at stations at which there is no platform lighting.

Mounted in the roof at each end of the train is a 250-watt head-lamp and a red tail light tell-tale is fitted on the dash. The cab and engine-room lights, guard's compartment lights, and instrument lights have individual switches in suitable positions. Bell pushes throughout the train give communication with the driver.

For the train exterior an attractive color scheme has been adopted. The roof and body sides down to the waist rail level are painted aluminium grey. Below this point the body panels are green and a black line separates the two colors. The skirting panels below the floor level are painted in the same shade of aluminium grey and the buffers are painted red. Although a maximum speed limit of 45 m.p.h. is in force on the section of the railway on which the trains are to operate, the trains are designed for a speed, when fully loaded on level tangent track, of 55 m.p.h.

The entire work involved was carried out at the English Electric Company's Rugby, Bradford, and Preston works, and after the erection at Preston, each train was subjected to final testing on the test track, after which the coaches were shipped in the completely erected condition.

New Facts Concerning Soviet Oil Reserves

(Continued from page 109)

Our reserves of oil are immense, but our requirements are also great, and growing from day to day. The number of tractors on the collective and State farms last summer had reached 450,000, having an aggregate of more than eight million h.p.; more than 100,000 combine-harvesters were used in the fields; and the number of these machines will go on increasing. At present, about 90 motor-cars and 700 lorries come off the conveyors of our automobile factories every day. This year, with the completion of the reconstruction work being carried out at the Stalin Automobile Plant in Moscow and the Molotov Automobile Plant in Gorky, the output of motor-cars and lorries will be greatly increased.

All this motor transport requires oil. And then, there are aeroplanes, and the needs of other industries, all dictating the need to increase the output of oil and oil products—high-grade benzine, lubricating oils, and the like.

Special Concentration Process at Showa Steel Works, Anshan

(Continued from page 115)

as a result of the successful execution of the second stage expansion project undertaken, following the materialization of the original plan.

With the expansion of the Showa Steel Works, various heavy industrial companies have been established one after another, which have come to form a strong steel industry bloc, with the Showa Steel Works as the nucleus.

During 1938, the third and fourth stage expansion projects will be completed, whereupon the present productive capacity of the Showa Steel Works will be increased to 1,700,000 tons of pig iron and 1,000,000 tons of steel under the new national steel policy of the Japanese Government, and a further increase in the use of lean Anshan ores is predicted because of the national emergency now confronting Japan.

Engineering Notes

INDUSTRIAL

RAYON OUTPUT.—Japanese rayon output, excluding staple fibre, reached in May, 1937, the record total of 27,960,000 lb. Exports amounted to 6,000,000 lb.

WORK AT SHANGHAI.—In addition to the flood-wall which is being erected along the Bund by the Shanghai Municipal Council, a portion of the Quai de France (French Bund) is being raised.

STAPLE FIBRE.—Japanese production of staple fibre in July amounted to 16,900,000 lb., against 15,300,000 lb. in June and 12,900,000 lb. in May. The average monthly output during last year was only 3,800,000 lb., and the output is now being pushed forward with all haste in order to conserve supplies of raw wool and reduce the necessity to import the latter.

BEATING THE QUOTA.—In his latest report on the working of the textile quota system in Malaya, Mr. H. North-Hunt, the Registrar, throws illuminating and amusing light on the ingenious devices employed by smugglers to "dodge" the quota. One instance concerns various types of trousers, very tightly tacked together and not shaped or cut in any way. The turnups at the bottom were three or four-fold, and contained several yards of material. In fact, a pair of trousers disintegrated into 12 yards of cotton piece goods!

STEEL BUYERS' GUIDE.—Edgar Allen & Co., Ltd., have brought out a new publication called "The Steel Buyers' Guide." This is a handbook to the correct steels for particular parts and purposes. It is a quarto book of 56 pages printed in two colors in clear readable type and gives, in tabular form, and in alphabetical order, a comprehensive list of parts and purposes for which steel can be used. In the first column, immediately following the name of the part is given the particular Edgar Allen Steel recommended, but in order that the book shall be of use whether the reader buys Edgar Allen steels or not, the exact character of the steel is described in a second column. Further columns give an alternative steel and its type. The book consists solely of these tables.

TIENTSIN ELECTRICITY.—The Electric Power Federation, consisting of Japan's "Big Five" power companies, has decided to invest 2,000,000 yuan in the Tientsin Electricity Company. Although steam power generation in Peiping and Tientsin involves only 100,000 kilowatts, the Federation intends to begin at Tientsin with the erection of a steam power plant capable of generating 30,000 kilowatts, and costing Y.8,000,000, a joint investment by the Tientsin City Office and the Federation. Mr. Shinji Sogo, president of the new company, recently called on Sir G. B. Sansom, Commercial Counsellor of the British Embassy in Tokyo, in connection with the Tientsin company's plan of buying Kaiping coal from the Kailan Mining Administration at Tientsin, under British management, for use in the new plant.

JAPANESE MACHINERY TRADE.—The United States Bureau of Foreign and Domestic Commerce, in a recent report reveals that Japanese machinery imports from 1933 to 1935 increased 45 per cent, while during the same period exports rose 141 per cent. The leading import classes were metal-working and woodworking machinery, internal-combustion engines, steam boilers, textile and sewing machines, card clothing machinery, pumps and compressors, hydraulic presses, steam turbines, paper-making machinery, and rolls and rollers. The leading groups in the export trade were locomotive, spinning and weaving machines, internal combustion engines, cranes, printing machinery, steam boilers, pumps, and metal and wood-working machinery. Most of the machinery imported into Japan is supplied by the United States, Germany and the United Kingdom.

SEEKS GERMAN TRADE.—Economic co-operation between Germany and Japan is to be further strengthened, according to the *Asahi Shimbun*. The newspaper states that the special trade agreement between Germany and Manchoukuo is to be extended to Japan. With this end in view, Vice-Admiral Takuo Godoh is to visit Germany. Last year Japan bought £6,800,000 worth of goods from Germany, who bought a little more than £2,000,000 worth in return, but this year Japan had by August already bought Y.120,000,000 worth of goods from Germany. The annual maximum of exports from Manchoukuo to Germany, says the newspaper, will be increased to Y.200,000,000, thus doubling the exports, while in return Germany would grant to Manchoukuo a credit of Y.100,000,000.—*Reuter*.

AMERICAN TRADE.—The United States Department of Commerce announced the American trade with the Far East had increased steadily for 1937. United States exports to Japan during the first eight months of the year amounted to \$216,720,000 (about £43,700,000)—an increase of 87 per cent compared with the similar period of last year. United States imports from Japan during the first eight months of 1937 totalled \$143,793,000—an increase of 33 per cent as against last year. United States exports to China during the period in question aggregated \$43,007,000—an increase of 39 per cent; while imports from China amounted to \$80,764,000—an increase of 45 per cent. The principal sales to Japan were cotton and scrap iron and steel, while exports to China covered a wide range of commodities, but included a considerable amount of aviation equipment.—*Reuter*.

JAPANESE TRADE.—The foreign trade of Japan for the first six months of 1937 consisted of imports valued at Y.2,242,887,000 and exports at Y.1,601,777,000. The adverse balance was Y.641,110,000 (about £37,400,000), an increase of Y.326,686,000 (about £19,058,000) over that for the corresponding period of 1936. According to the *Domei Agency*, the phenomenal import rise of raw materials in connection with the proposed expansion of the productive capacity of Japanese industries accounts for the largest adverse balance for 20 years. The sole exception is 1924, the year after the big earthquake in the Tokyo district.

SHIPPING

SHIPS FOR SIAM.—Two training ships, built for the Siamese Navy at the Uraga Dockyards, Japan, were officially turned over on June 19. On June 21 they were joined by three coastguard cruisers, also built in Japan, and the five vessels sailed for Bangkok at the end of the same month.

SHIPPING TALKS.—Following a conference between the Government Departments concerned with communications and transport and the Japanese shipping companies, it has been decided that the projected Anglo-Japanese conference on the subject must be held in Tokyo, but that it will be postponed until after the end of the Sino-Japanese war.

NEW SHIP SERVICE.—The Osaka Shosen Kaisha, second largest shipping company in Japan, contemplates a direct service to South America via the Panama Canal with four steamers. The Tokyo Ministry of Communications has advised shipowners to put more ships on the lines to India and other South Sea ports for transportation of iron ore, pig iron, and raw materials.

NEW FACTORY SHIPS.—Permission to construct two 20,000-ton whalers and ten catcher-boats to be ready for the 1940 season has been given by the Japanese Ministry of Agriculture and Forestry to the Great Japan Pelagic Whaling Company. These new ships will bring the total number of Japan's large floating whaling factories up to ten, and the Ministry will not issue any further permits for the construction of whalers.—*Reuter*.

OPPOSES PURCHASES.—Bitter opposition to the purchase of foreign vessels is voiced in a statement issued by the powerful Kobe Shipowners' Association. "Importation of foreign vessels," the statement declares, "is contrary to the adopted shipping policy, which aims at raising the standards of the Japanese merchant marine.... Purchases of aged foreign bottoms merely because of a temporary boom will be a constant menace to Japanese shipping. The inevitable lowering of shipping charges will lead to a forfeiture of international confidence in the Japanese merchant marine. Moreover, the purchases of old bottoms, coupled with the current brisk construction of crack vessels in this country, are bound to result in an over-supply of ships."

NEW SHIPS ORDERED.—Contracts for the construction of fifteen freighters and seven high-speed passenger-cargo vessels have been awarded Japanese yards by the Nippon Yusen Kaisha. Included will be three 16,500-ton ships, developing 21 knots, to be assigned to the Japan-Europe run via Suez; two 11,700-ton twenty knotters for the Japan-Australia route, and two 10,600-ton motorships, also 20 knots speed, for the Kobe-Seattle line. Eleven freighters displacing 7,000-tons developing a speed of nineteen knots and four slower 4,000-ton cargo vessels are also in the program. The firm intends to inaugurate a round-the-world freight line, starting in July. The ships will proceed from Japan, through the Panama Canal, and return by way of Suez.

RAILWAYS

CRANES FOR SIAM.—Two locomotive break-down cranes, worked by steam or heavy oil engines, and two match trucks, are required by the Royal State Railways of Siam. Each crane should be capable of lifting a load of 25 tons at an approximate radius of five meters, and 12 tons at an approximate radius of seven meters, when blocked up on outrigger girders. The gauge of the railways is one meter. Tenders for the cranes are due in Bangkok by October 29.

MANCHURIAN RAILWAYS.—To carry out its program of railway building and industrial development, the South Manchuria Railway Co. intends to borrow about Y.136,000,000, in addition to appropriating about Y.30,000,000 from its reserve. Y.30,000,000 would be secured from the Industrial Bank of Japan; Y.56,000,000 from the Japanese Government and private investors; Y.10,000,000 from the Central Bank of Manchoukuo; and the rest by floating debentures. The suggestion to finance new enterprises of the S.M.R. has not found favor with the Manchoukuo Industrial Bank, which says it would be preferable for the S.M.R. to float loans in Japan. Any attempt at large-scale financing in Manchoukuo might disturb the money market.